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DECEMBER 17, 1984

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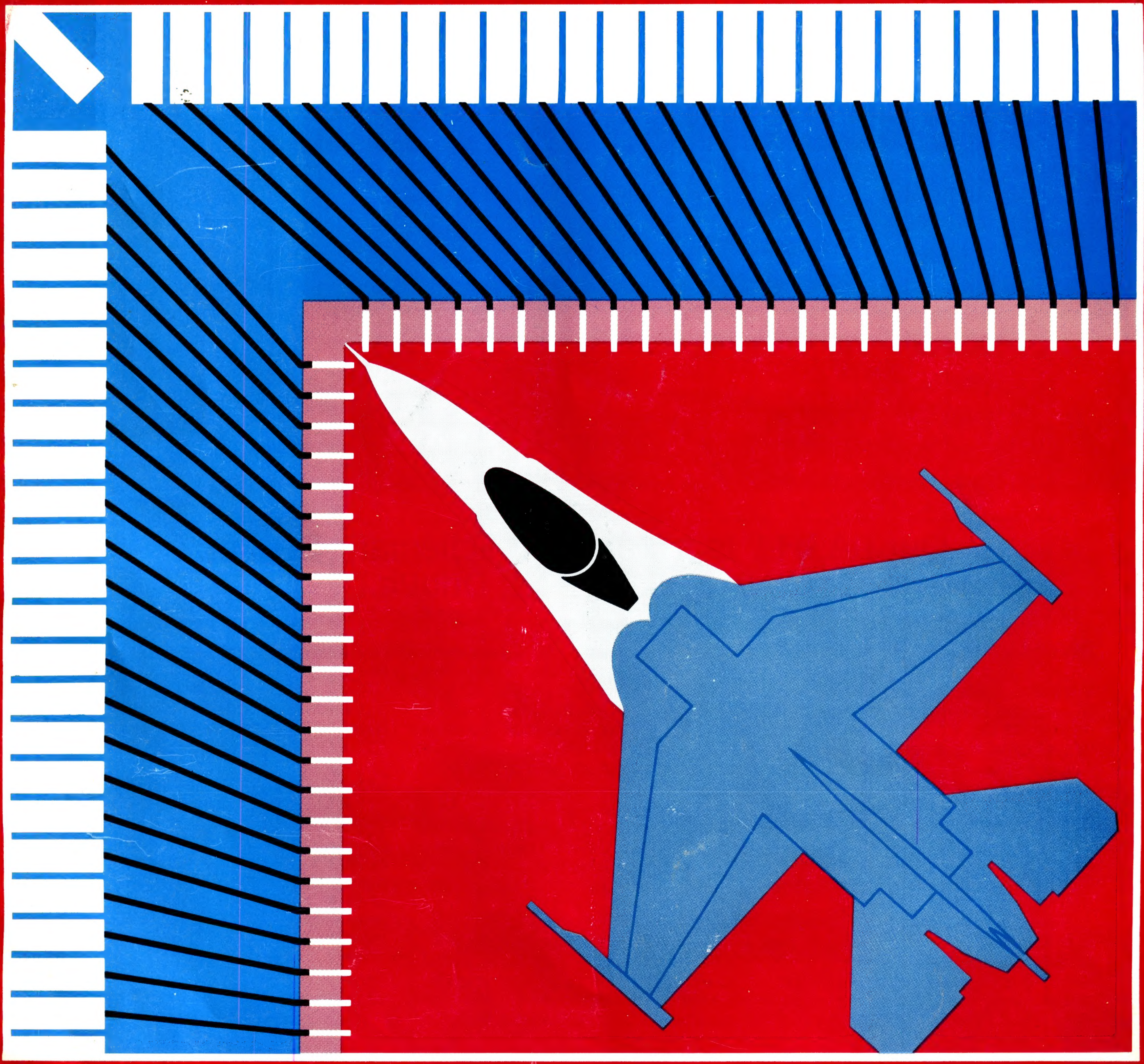

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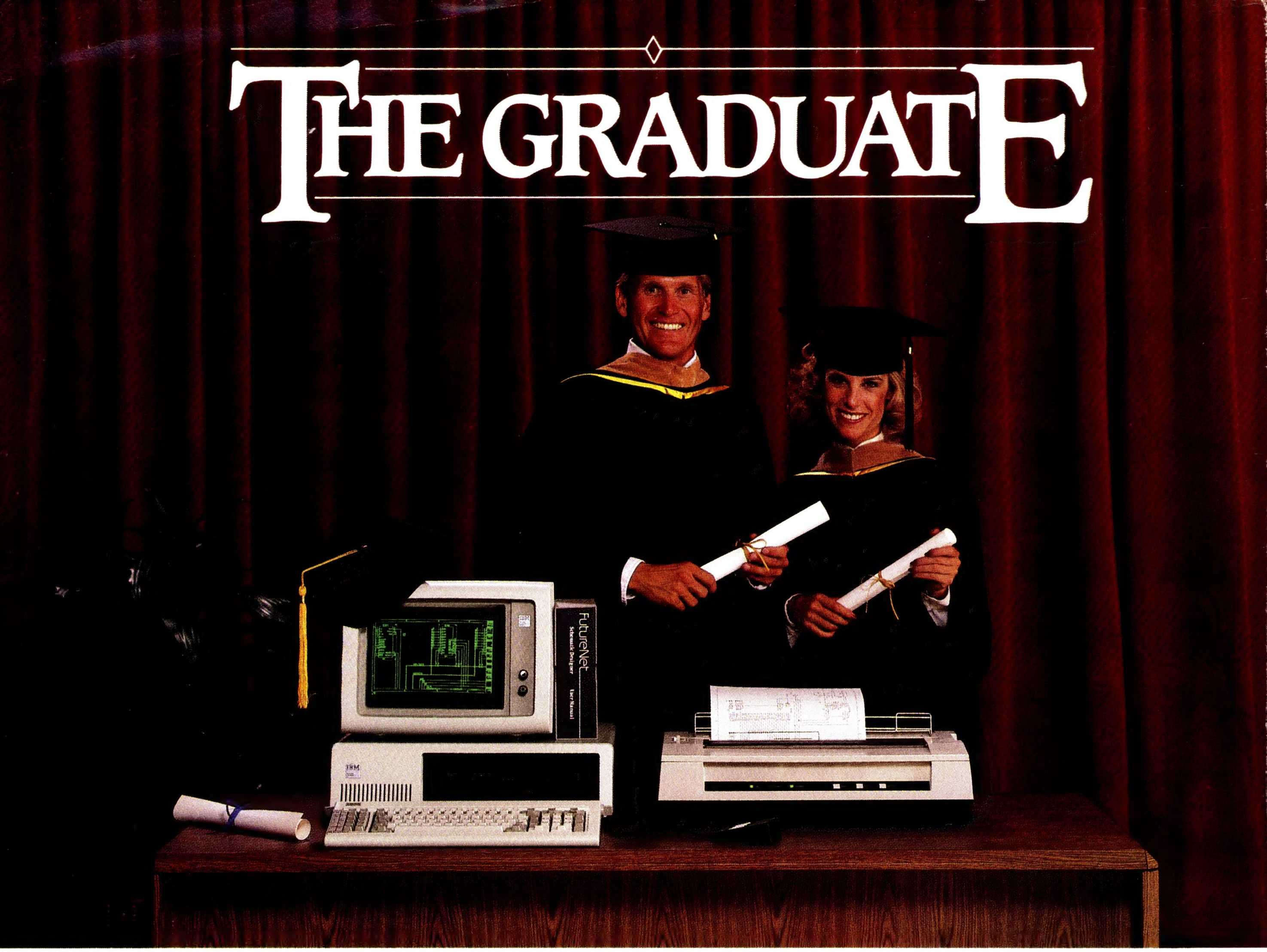

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ElectronicsWeek

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Next ElectronicsWeek

Annual Market Report analyzes the figures for 1985

Coming up in the next issue, Jan. 1, 1985, will be the eagerly awaited Annual Market Report, the sector-by-sector analysis of what 1985 will be like. Compiled in New York by Business Editor Robert J. Kozma, the article contains reporting from *ElectronicsWeek*'s 11 news bureaus in the U.S., Europe, and Japan. In addition, there will be authoritative figures charting the next 12 months. It's the highlight of an issue that no one involved in the electronics industries can afford to miss.

MOS meets the radiation challenge

Up to now, systems that required radiation-hardened integrated circuits also required bipolar ICs or some exotic—and expensive—semiconductor techniques. However, new processing methods, geometries, and materials that are being used in new MOS and CMOS circuits to increase performance and density have also shown increased tolerance to radiation. Examine these new developments in the Jan. 1 issue in an article by Carl Gusert of Intel Corp. and Kenneth A. Marks of the Boeing Radiation Effects Laboratory.

Looking ahead in ElectronicsWeek

The bills for Christmas 1984 may still be unpaid, but the consumer electronics people are about to assemble in Las Vegas to decide what technologies to put their money on for the Christmas 1985 selling season. The event is the Winter Consumer Electronics Show, one of the biggest events on the industry's calendar. For a sneak preview, check the special technology reports in an upcoming issue.

What is random repetitive sampling? Briefly, it is a technique that, by using a digital oscilloscope, permits signals to be stored independently of their relationship to a trigger. To learn more about random repetitive sampling's applications and advantages, see a future issue of *ElectronicsWeek.*

December 17, 1984 Volume 57, Number 36
100,693 copies of this issue printed

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill, Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: MCGRAWHILLNEWYORK.

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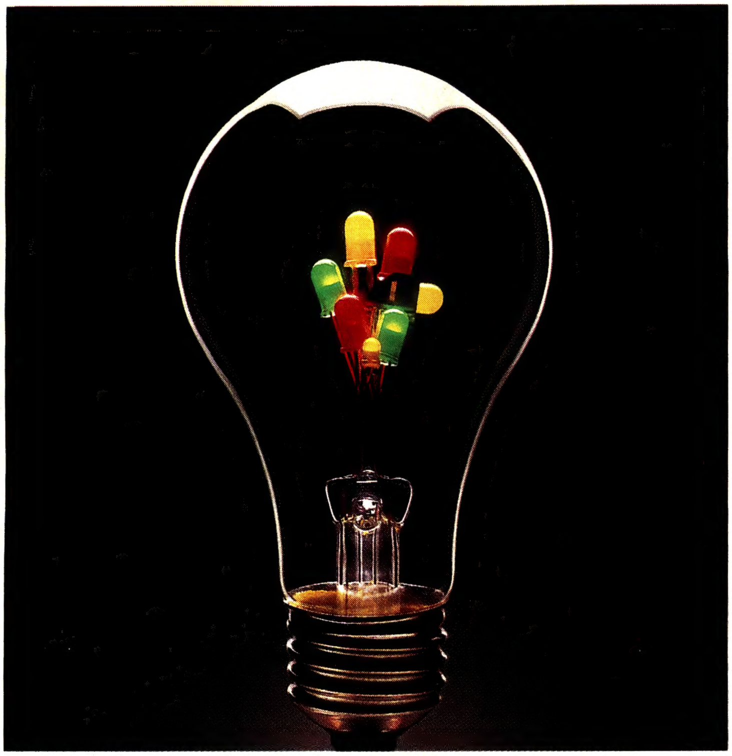

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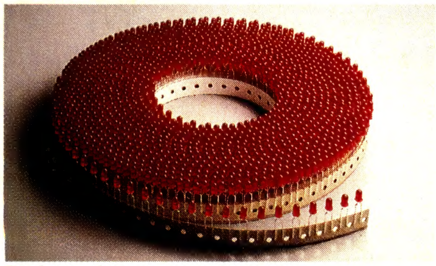

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VHSIC's SPIN-OFFS

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Technology Around the World

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VOLUME 57, NO. 36 DECEMBER 17, 1984

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Special Technology Reports

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Executive Outlook Executives see fairly smooth road for 1985 even though threats of a zooming deficit, higher interest rates, and a cooled-off recovery late in the year could lead to a gloomier outlook for the electronics community **86**

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Labor index points to poor year for chip makers . . .

December layoff announcements at Texas Instruments Inc. and Synertek Inc. may be only the first signs of a serious squeeze on workforces by chip makers. Advanced Associates, whose C-1 labor index has called the turn on employment levels accurately over the past decade, now forecasts an 8% to 10% workforce reduction by the middle of the second quarter. The index, says Phil Holden, president of the Richardson, Texas, consulting firm, shows total employment up 34% in the past two years. But it registered a slowdown in the growth rate last September. And near the end of the first quarter or early in the second quarter of 1985, the industry is expected to cross the index's "unity" line—where the total labor force begins to shrink.

. . . as book-to-bill ratio continues to slide

For the second straight month, the semiconductor book-to-bill ratio in November hit an all-time low, falling to 0.61 from the 0.67 registered in October. It was the 11th month in a row that the index had declined since hitting its all-time high of 1.66 last December. The Semiconductor Industry Association, which in September had predicted a 53% jump in semiconductor sales in 1984 and 21% growth next year, has now slashed the figures to 46% for 1984 and a mere 10% in 1985.

Computer makers, as well, will find scant joy in 1985 . . .

Add the Computer and Business Equipment Manufacturers Association to the growing list of businessmen who are convinced the economy has slowed. CBEMA now predicts that revenues in its industries will grow by 12.4% in 1985 to reach $173 billion. That represents a sharp drop from the 18.5% sales jump made in 1984 and falls short of the 14.1% average growth rate that has marked the industry's last 10 years.

. . . with even the fast-growing software industry threatened

If the U.S. software industry can withstand mounting competition from foreign sources, its worldwide revenues could grow by 30% a year to reach $41 billion by 1987 and account for 75% of the world market, asserts a new study by the Department of Commerce. Currently, the industry faces competitive disadvantages because of rampant software piracy and market restrictions in foreign nations. In the future, improved software engineering and cheaper labor costs could give overseas houses an edge, the study predicts.

TI researchers stack their chips for high density

Researchers at Texas Instruments have developed an experimental 64-K static random-access memory, the first, they say, to use fully self-aligned stacked CMOS technology. The structure immunizes high-density static RAMs to upsets by alpha particles. Although there have been other stacked CMOS memories, this is the first in which the p-channel devices overlaid on the n-channel devices built in the bulk silicon are self-aligned to the gate electrodes underneath. The process permits fabrication of extremely small channel lengths and thus can take full advantage of the stacked geometry to produce very small cell sizes. The memory was described last week at the International Electron Devices Meeting in San Francisco.

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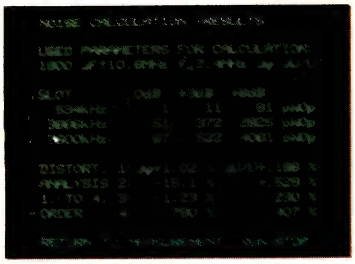

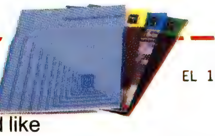

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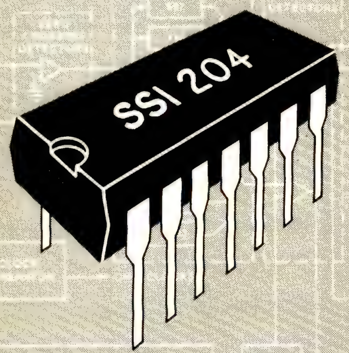

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Meetings

3rd International Modal Analysis Conference, The International Society for Modal Testing and Analysis and Union College (Peter B. Juhl, Union College, Graduate and Continuing Studies, Wells House, 1 Union Ave., Schenectady, N.Y. 12308), Orlando Marriott Inn, Orlando, Fla., Jan. 28-31.

Communication Networks Conference & Exposition, Conference Management Group (375 Cochituate Road, Box 880, Framingham, Mass. 01701), Washington Convention Center, Washington, Jan 28-31.

Industrial Productivity Conference and Exposition, Society of Manufacturing Engineers (1 SME Dr., Dearborn, Mich. 48121), Expo Centre, Orlando, Fla., Jan. 29-31.

Micro-Computer '85, Messe Frankfurt Ltd. (Philippe Hans, German American Chamber of Commerce, 666 Fifth Ave., New York, N.Y. 10103), Frankfurt Fairgrounds, Frankfurt, West Germany, Jan. 29-Feb. 3.

Aerospace Applications Conference, IEEE (Russell Gaspari, Hughes Aircraft, MS S12/W315, P.O. Box 92919, Los Angeles, Calif. 90009), Snowmass, Colo., Feb. 2-9.

1985 Office Automation Conference, American Federation of Information Processing Societies Inc. (1899 Preston White Dr., Reston, Va. 22091), Georgia World Congress Center, Atlanta, Feb. 4-6.

Fourth Middle East Communication Show, Kallman Associates (5 Maple Ct., Ridgewood, N.J. 07450), Bahrain, Feb. 4-7.

Mini/Micro West, IEEE and ERA (Electronic Conventions Management Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045), Anaheim Hilton Exposition Center, Anaheim, Calif., Feb. 5-7.

The Annual Conference on Automation Technology For Management and Productivity Advancements Through Distributed CAD/CAM and Engineering Data Handling Systems, Automation Technology Institute (P.O. Box 242, Pebble Beach, Calif. 93953), Monterey Conference Center, Monterey, Calif., Feb. 5-7.

Winter Meeting, Power Conversion Products Council International (Betsy Bevington, PCPCI, P.O. Box 637, Libertyville, Ill. 60048), The Doubletree Inn, Scottsdale, Ariz., Feb. 6-8.

Stride Faire '85, Stride Micro (Stride Micro, 4905 Energy Way, Reno, Nev. 89502), MGM Grand Hotel, Reno, Nevada, Feb. 8-10.

Optical Fiber Communication Conference, IEEE and Optical Society of America, (OSA, 1816 Jefferson Pl., N.W., Washington, D.C. 20036), Town & Country Hotel, San Diego, Feb. 11-13.

Southern Telecommunications Showcase '85, United States Telecommunications Suppliers Assoc. (333 N. Michigan Ave., Suite 1618, Chicago, Ill. 60601), New Orleans Convention Center, New Orleans, Feb. 12-14.

The Golden Gate Metals and Welding Conference, American Society for Metals, *et al.* (Kim Mahin, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, Calif. 94550), Sheraton-Palace Hotel, San Francisco, Feb. 12-15.

Seminars

User Documentation, American Management Associations (Box 319, Saranac Lake, N.Y. 12983), Amfac Hotel, Los Angeles, Jan. 28-30.

Long-Range Information Systems Planning, American Management Associations (Beth Ranney, Program Director, American Management Associations, 135 West 50 St., New York, N.Y. 10020), Phoenix Hilton, Phoenix, Ariz., Jan. 28-30.

International Solid-State Circuits Conference, IEEE (345 E. 47 St., New York, N.Y. 10017), New York Hilton, New York, Feb. 13-15.

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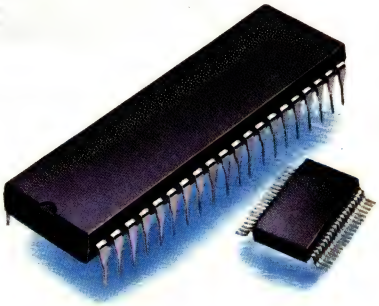

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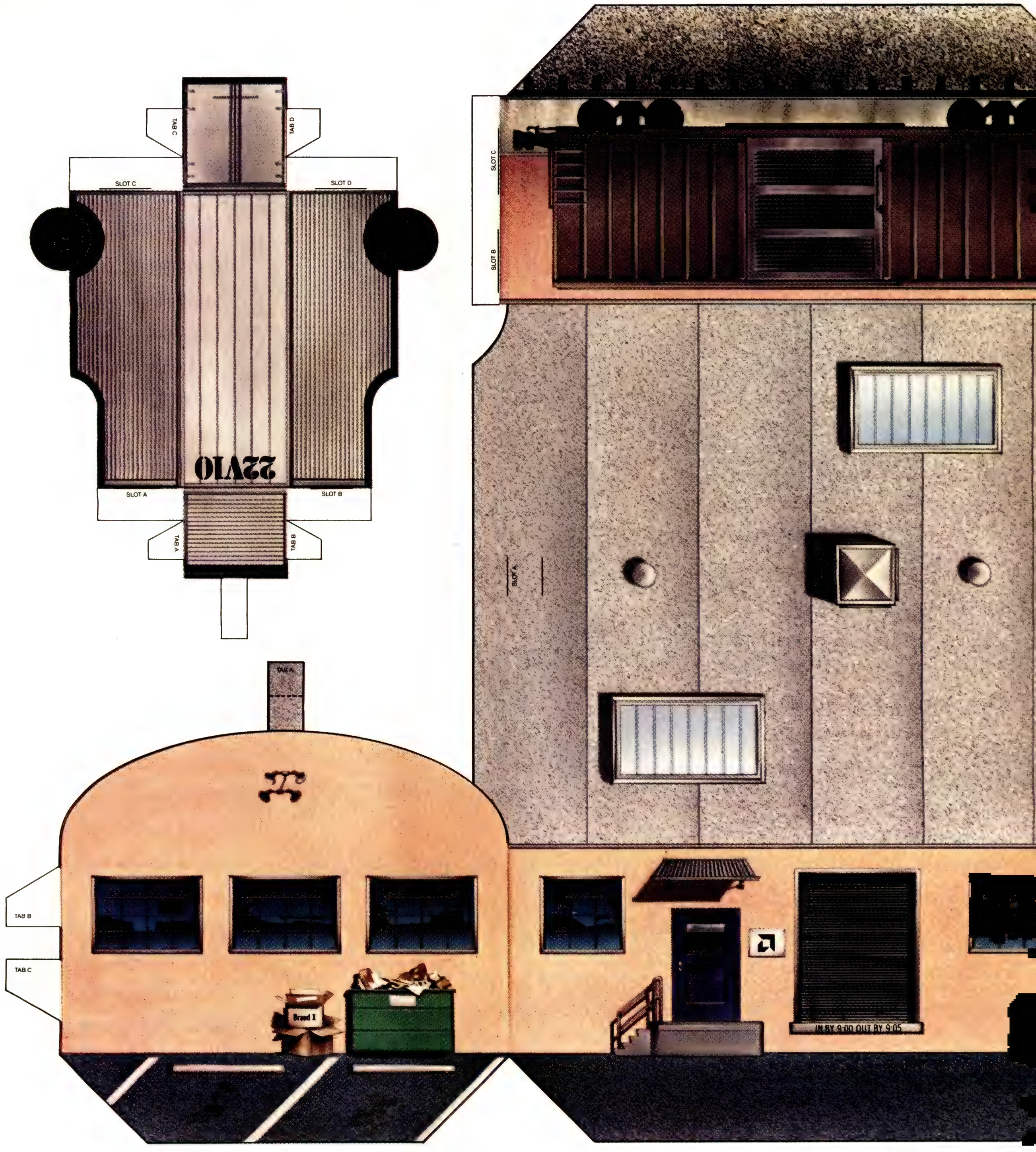

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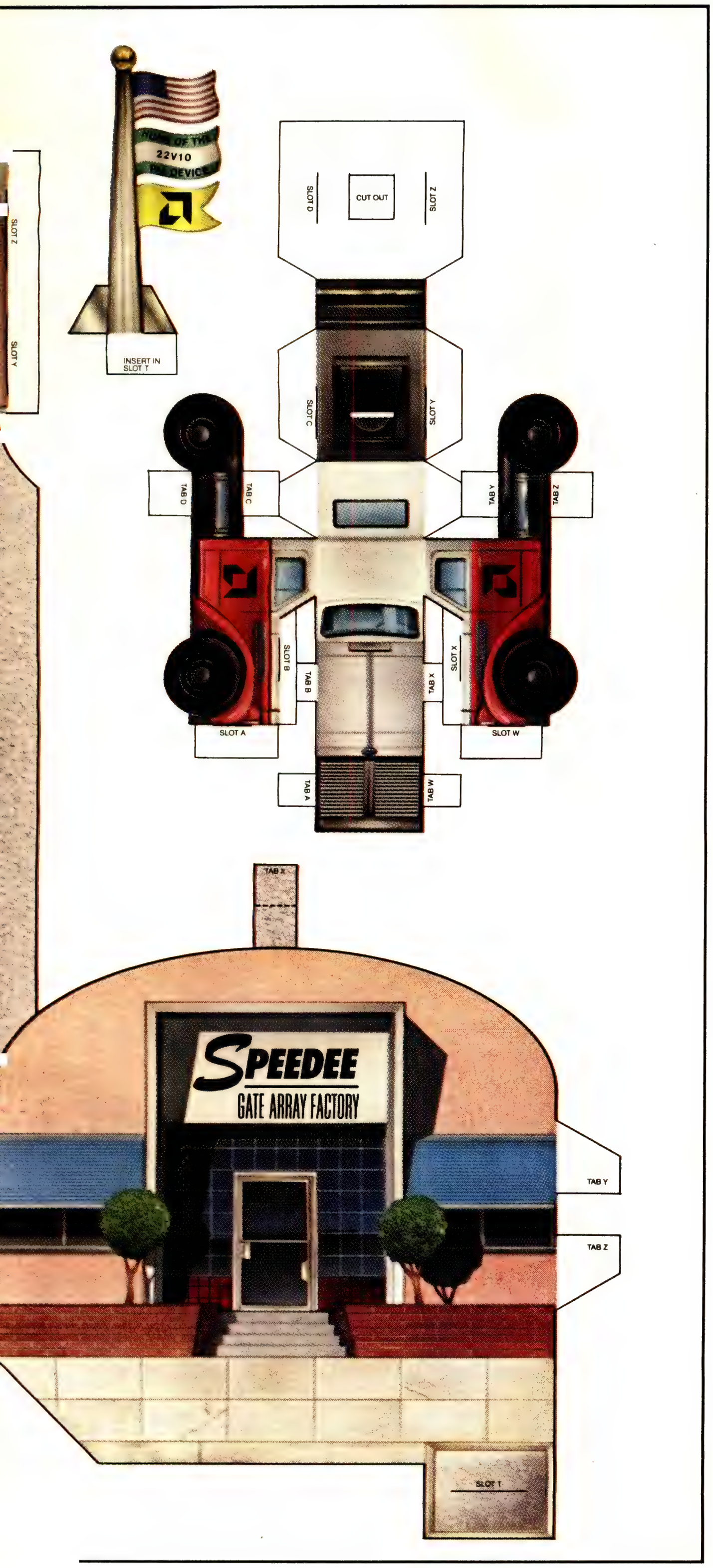

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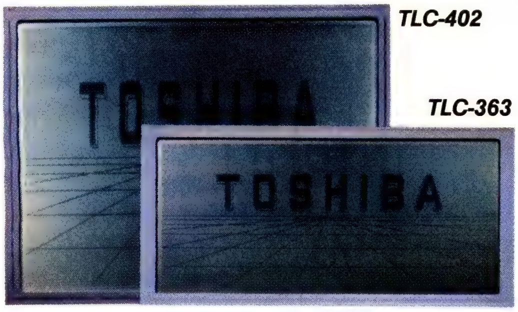

Specifications

		TLC-402	TLC-363
Display			
Number of Characters		80×25 (2,000 characters)	80×25 (2,000 characters)
Dot Format		8×8, alpha-numeric	8×8, alpha-numeric
Overall Dimensions (W×H×D)		274.8×240.6×15.0 mm	275.0×126.0×15.0 mm
Maximum Ratings			
Storage Temperature		–20 – 70°C	–20 – 70°C
Operating Temperature		0 – 50°C	0 – 50°C
Supply Voltage	V_{DD}	7 V	7 V
	V_{DD}-V_{EE}	18 V	18 V
Input Voltage		$0 \leq V_{IN} \leq V_{DD}$	$V_{SS} \leq V_{IN} \leq V_{DD}$
Recommended Operating Conditions			
Supply Voltage	V_{DD}	5 ±0.25 V	5 ±0.25 V
	V_{EE}	–13 V Max.	–13 V Max.
Input Voltage	High	4.0 V Min.	4.0 V Min.
	Low	0.5 V Max.	0.5 V Max.
Typical Characteristics (25°C)			
Response Time	Turn ON	300 ms	300 ms
	Turn OFF	300 ms	300 ms
Contrast Ratio		5	5
Viewing Angle		15 – 35 degrees	15 – 35 degrees

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AROUND THE WORLD

AI TRANSFORMS CAD/CAM TO CIM

Industrial heavyweights aim for computer-integrated manufacturing expert systems to link work stations to factory

☐ *By J. Robert Lineback*

Arlington, Texas

In the past, factory-automation architects have concentrated on computer-aided manufacturing systems to assist modern plant managers in improving production efficiency, yields, and quality. Now, many automation experts believe that factory computers are due for a round of promotions to the level of expert systems in manufacturing, planning and process control.

CIM—short for computer-integrated manufacturing—has already supplanted the popular term CAM. "We are taking that one step further, with CIM becoming computer-intelligible manufacturing systems," explains William A. Carter, senior vice president and general manager of the industry trade association Computer Aided Manufacturing-International Inc. in Arlington.

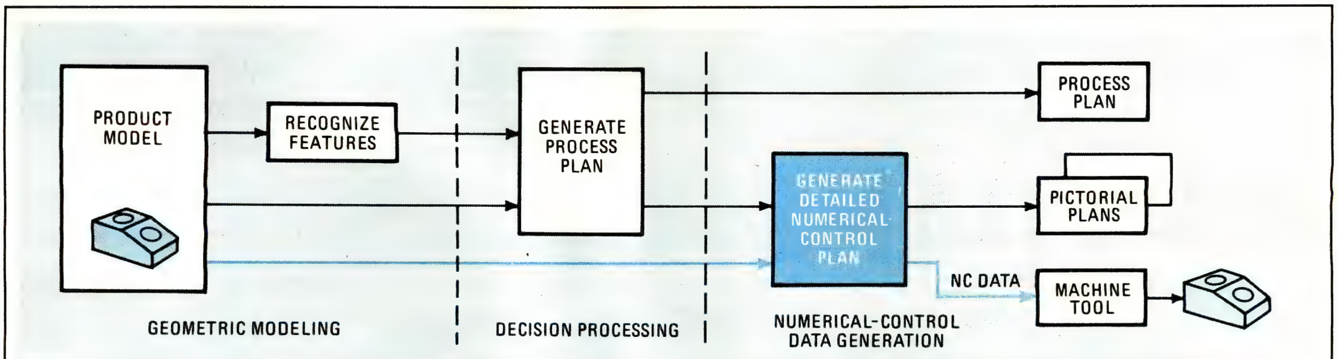
Systems bridge. Within two months, CAM-I will officially launch an aggressive four-year development project to create an expert-systems bridge spanning the growing number of engineering work stations and the highly automated factories of the future. The $23 million project, backed by seven corporations and two federal agencies, will first be aimed at the metal-machining requirements of the automotive, aerospace, and tooling industries. But much of the resulting artificial-intelligence expertise is also expected to be applicable to assembly- and processing-intensive work, such as electronics production.

Similar efforts are under way at Westinghouse Electric Corp. to create fully integrated process-planning systems for sequential operations such as electronics assembly. Already, the firm has applied expert-planning systems for products such as hybrid circuits, printed-wiring and printed-circuit boards, and inductive magnetic devices, says John Decaire, manager of design and producibility engineering at the company's Defense Electronics Center, Baltimore.

In Westinghouse's setup, completed designs from computer work stations must be manually rekeyed into a system called Wicapp (for Westinghouse Integrated Computer-Aided Process Planning). To do away with rekeying, the firm is developing a Wicapp interface for designer work stations. "When you connect the two, a designer will not only do the product development but will also be able to automatically create the process plan, combining engineering disciplines traditionally separated between designers and process or industrial engineers," Decaire suggests.

Westinghouse is even taking the automation of product development-to-production cycles further by applying "design algorithms" to specifications for array antenna products. These

CIM seer. CAM-I's William Carter aims to employ AI technologies for integrated manufacturing systems.



All tied together. In a four-year project, CAM-I plans to create an expert-systems bridge that will tie engineering work stations to automated factory production equipment. After geometric modeling, the system plans the production process and then generates numerical-control data.

algorithms not only complete the antenna design but will also plan out the manufacturing process.

Although they have not been called "expert systems," earlier commercially available process-planning programs have contained algorithms to refer to past "experiences" and classify parts into categories that help engineers map out manufacturing techniques, says Richard Simon, director of CIM operations at Computervision Corp., Bedford, Mass.

Under what he calls "variant" process-planning systems, the software uses product codes to place new designs in part families. Each family has common processing methods, and human planners can use the outputs to fine-tune processing for the new parts. Computervision markets such a computer-aided planning system, called MultiClass, which runs on minicomputers and mainframes.

The next step. "In process planning, a valid description of an expert-based system would be the next step, what we call a 'generative' planning system," Simon explains. "It is where we are moving but we are not there yet," he adds. CAM-I's four-year project is aimed at taking such a step.

Carter says nearly all modern industries are now faced with clearing the "thinking wall." As he explains, "There is almost no way to further automate processes until the knowledge of process planners and their decisions is computerized." For that reason, CAM-I believes it can make broad use of advances in generic new methodologies for form-feature recognition, geometric data formats, software interfaces, and production-planning expert systems.

CAM-I's goal is to create a series of new software systems that will automatically generate complete process plans and numerical-control programs for the factory after product designs are completed on solid-modeling graphics work stations. The systems will contain AI-based technologies such as algorithms for feature recognition and extraction, knowledge-base expert systems, and advanced software for intelligent factory-floor numerical controllers.

Called Integrated Manufacturing Planning and Control Technology, or Impact, the project is intended eventually to provide the ultimate link between computer design and production by eliminating the need for engineering drawings and human intervention in deciding the best way to produce a product, says Carter (see diagram).

The current lineup of sponsoring firms includes such heavy hitters as IBM, General Motors, General Electric, Boeing, McDonnell Douglas, General Dynamics, and Martin Marietta. Initially, they are chipping in close to a million dollars each. The association is also getting funds and backing from the Aeronautical Materials Laboratory at Wright-Patterson Air Force Base in Dayton, Ohio, and the U.S. Department of Energy.

What is knowledge? "The difficulty—as with most artificial-intelligence fields—is knowing what is knowledge," cautions Carter. "In manufacturing, we do not have nice little documents of knowledge. Rather, it is a collection of bits and pieces, ideas, catalogs, and unconnected thoughts. So, we are searching new ground in trying to put this together."

That uncharted territory includes ways of enabling computers to recognize and fully understand three-dimensional features found in metal product designs (such as through-holes, pockets, flat surfaces, and curves). The system must have knowledge of material characteristics and the effect of the combination of features on the production sequence. It will know about the capabilities and limitations of a wide range of factory equipment, including numerically controlled machines and robots.

More power needed. Process-intensive 3-d geometric data and engineering knowledge bases are expected to result in a shortage of computer power. Therefore, CAM-I is considering parallel-processing architectures, says Peter Downey, the association's vice president of technology. "Data would have to be structured for concurrent processing, a divide-and-conquer approach," he adds. CAM-I officials have already discussed such an avenue with Denelcor Inc. of Aurora, Colo., a maker of parallel supercomputers and a CAM-I member.

Results of the work will become the property of the sponsors, but CAM-I intends to make public the data-formatting standards and interfaces. For that reason, Carter says, it is working closely with organizations such as the National Bureau of Standards, the Initial Graphics Exchange Specification (IGES) group, the American National Standards Institute, and the International Organization for Standardization.

In its first year, the Impact project will concentrate on system specifications and enabling technologies, such as the general-purpose kernel for the expert planning system and algorithms for feature isolation through volume decomposition. System development will stretch from 1986 to 1988, and integration is slated for the final year.

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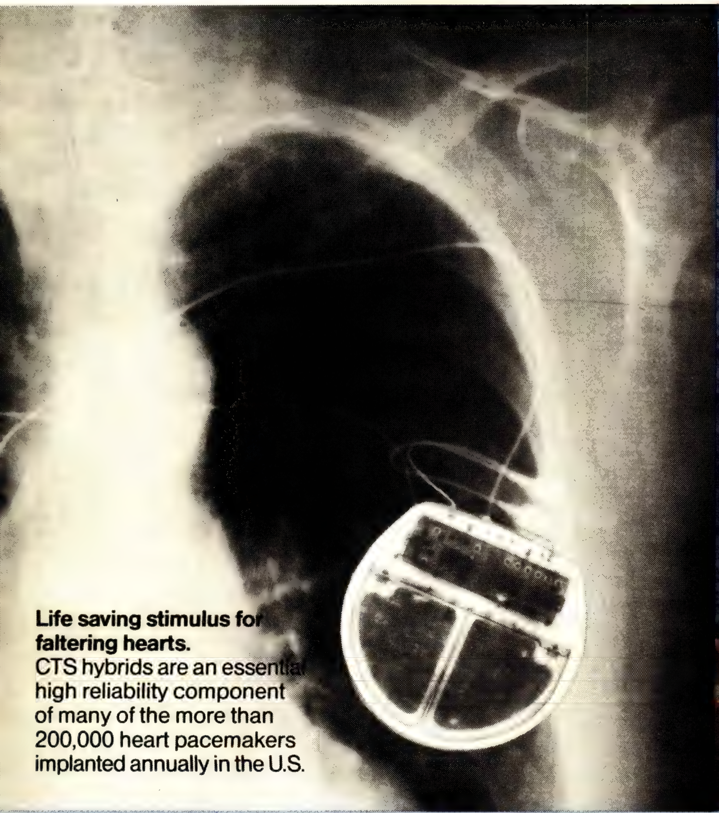

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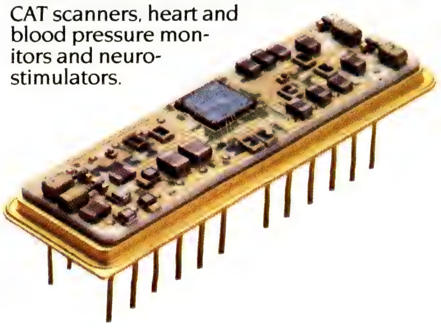

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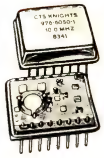

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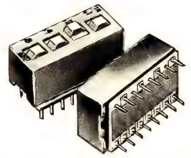

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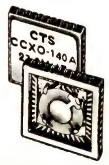

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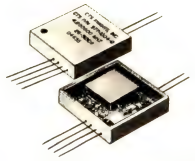

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FACTORY NETS FOLLOW A MAP

GM has won impressive endorsements for a factory-automation protocol that's destined to be a standard

By George Leopold

New York

The drive to integrate the so-called islands of factory automation through multivendor local-area networks has gained sufficient momentum that shop-floor communications standardization appears to be just around the corner. To a growing list of industrial manufacturers and computer-industry heavyweights, the solution appears to be a set of manufacturing-automation protocols, called MAP, being vigorously promoted by the General Motors Corp.

MAP, a broadband, token-bus-based communications standard, figured prominently in a discussion of industrial networks during an early-December conference on computer-integrated manufacturing held here by the Yankee Group, a research firm based in Boston. "MAP is off to a good start and has made quite an impression on the user community," the Yankee Group's Susan Lloyd McGarry told the conferees. "It is clear that MAP is gaining the endorsements it will need to become a standard."

To date, GM estimates that 50 vendors have endorsed the protocol, including IBM Corp. and Digital Equipment Corp. among the computer firms; manufacturers such as Ford, Boeing, Westinghouse, and General Electric; and chip makers Intel Corp. and Motorola Inc. In addition, approximately 200 companies have joined a MAP-users group organized by GM with the help of such firms as Eastman Kodak, Du Pont, and McDonnell Douglas. Indeed, says Mike Kaminski, GM's MAP project director, "We're beginning to get rumblings of support from Europe."

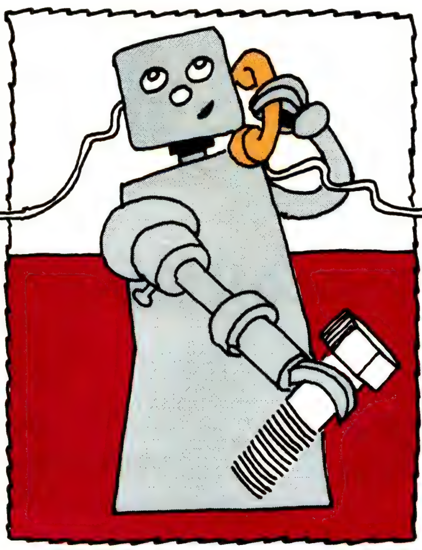
"All the big players in factory automation have endorsed it," notes C. Kenneth Miller, chief executive officer of Concord Data Systems, Waltham, Mass., who also addressed the conference. As a result, he adds, "MAP is rapidly becoming entrenched as the *de facto* standard for factory networking."

International flavor. Because the GM protocol incorporates international standards—from the Institute of Electrical and Electronics Engineers, the National Bureau of Standards, and the Open Systems Interconnection (OSI) models of the International Organization for Standardization—it shouldn't be considered as merely a *de facto* standard, counsels John Hefner, chief of the Systems Network and Architecture Division of NBS, headquartered in Gaithersburg, Md. Another NBS official, Robert Blanc, director of the Computer Systems and Engineering Center, also praises this approach, adding, "GM has organized the industry to bring about a standard."

MAP's attractiveness was further enhanced last July during a highly successful demonstration instigated by NBS at the National Computer Conference [*ElectronicsWeek,* July 23, 1984, p. 45]. Essentially designed to show the feasibility of MAP, the GM demonstration incorporated the internationally accepted transport protocols to simulate an automated factory.

The demonstration utilized Concord Data Systems' IEEE-802.4 standard token-bus network called Token/Net to provide flow control and error correction for programmable controllers from Gould Inc. and Allen-Bradley Co. Host computers from DEC, Hewlett-Packard, IBM, and Motorola used ISO transport protocols and message- and file-transfer protocols to monitor the controllers. Significantly, Miller notes, the network also collected shop-floor data that is seen as vital to integrated factories.

Now that four of seven ISO network-architecture layers have been implemented in MAP, GM will next demonstrate the ISO Internet proto-



col during the 1985 Autofact Show next November in Detroit, says Mark Cocroft, a GM spokesman at its technical center in Warren, Mich. "We have asked several PBX firms to participate," says Cocroft.

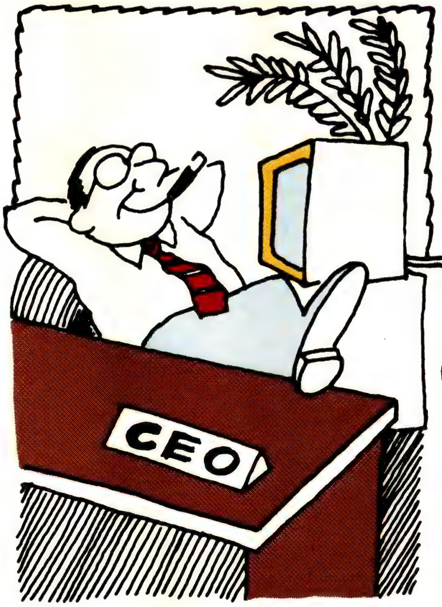
Full seven layers. But GM's most ambitious application of MAP will be in its Steering Gear Division's Factory of the Future project in Saginaw, Mich., where Kaminski predicts all seven ISO layers will be economically implemented by the end of 1988. He adds that chips and plug-in boards for the first five ISO layers should also be available by then.

The multivendor computer-integrated plant, one of five at the Saginaw site, already contains broadband coaxial cable and is expected to begin manufacturing front-drive axles by mid-1985. As a tuneup, GM will operate Allen-Bradley programmable controllers used for spray painting from a mainframe computer in Detroit, says Cocroft.

The need for standards such as MAP can best be seen as part of the more fundamental problems of underutilization of materials and equipment in today's automated, but chaotic factory, says the Yankee Group's McGarry. "I believe there is no such thing as computer-integrated manufacturing, no product you can go out and buy," she says. "Communications is really going to be the key to getting the most out of [manufacturing] equipment."

She foresees a manufacturing-communication hierarchy divided into three levels. Level III, the department level, would link many devices on the shop floor for specific purposes at speeds from 56 Kb/s to 5 Mb/s. Allen-Bradley's Data Highway is an example of such a system. The purpose of the Level III system, she explains, is to economically connect as many devices as possible and provide an interface to Level II.

Level II would be a moderately flexible plant-wide network operating at speeds of 5 Kb/s to 20 Mb/s with a general-purpose capability. It would connect devices to work stations or to the entire network. A corporate-wide network, or Level I, is envisioned as a highly flexible, high-speed (50 Mb/s and faster), general-purpose-capability network overseeing all factory operations from manufacturing and inventory to distribution and warehousing. "MAP is basically a plant-wide, Level II application," explains McGarry.



"One thing not to lose sight of is that MAP is not yet a fully specified protocol," she continues, adding that it may still be too unreliable for a factory environment distinguished by high levels of electromagnetic interference and high-voltage situations. "With any new network you have to prove it over time and get the bugs out. That's an issue with MAP." Moreover, the ability to detect and correct errors in the factory network automatically remains a missing link for information management.

Referring to the many influential firms it has attracted to MAP, "GM has brought together the buying power," says Hefner of the NBS.

Along with providing the test facilities for the NCC demonstration in July, NBS has also hosted a series of MAP workshops since January 1983 to determine which communications protocols were stable enough to be implemented.

He emphasizes the importance of establishing an ongoing test bed once feasibility has been demonstrated. To that end, NBS has formed an NBS-OSI distributed global network designed not only to develop test technology and implement protocols, but also to eventually link *all* elements of existing factory networks. By the end of 1985, NBS expects 100 companies to be participating in that project.

Chipping at costs. McGarry also notes that there is a question right now concerning how expensive MAP will be. For example, she cites the price tag for the Token/Net interface module, which currently costs $1,000 per connect. Indeed, besides completion of the remaining ISO layers, most observers agree that very large-scale integration chip-level implementation of the IEEE-802.4 standard is a necessity for bringing down MAP's cost.

Kaminski of GM expects chips to emerge during the second or third quarter of 1985. According to Jim Vittera, market development manager for Motorola in Phoenix, Ariz., its 68000 peripheral chip, called a token-bus controller, should be ready for beta-site testing during the third quarter of next year. VLSI development "will move everybody toward the [MAP] standard just because of the economy," Vittera asserts. Chip development is also being done by Intel and Gould-AMI in partnership with Concord Data Systems.

"We do expect that the price of MAP will continue to go down," explains GM's Cocroft, as modem size is reduced, software is integrated with hardware, and hardware becomes more reliable. Kaminski acknowledges that MAP implementation may require further debugging, but "we hope to have those soft spots worked out by next September"—in time for the opening of the Saginaw plant.

LASER VASTLY IMPROVES IRON-IMPURITY DETECTION

Argonne, Ill.—A laser-based surface-characterization technique with the potential for significantly increased sensitivity in detecting impurities in silicon wafers is being developed here by researchers at Argonne National Laboratory. What's more, the technique, unlike conventional approaches, is nondestructive.

The method has already been demonstrated to be 1,000 times more sensitive than currently available techniques used for detecting iron, an element that can cause problems in silicon devices but is particularly difficult to analyze when present in small quantities, says Dieter Gruen, associate director of Argonne's materials science and technology division. Gruen says additional development could improve sensitivity even more—to levels 1 million times better than today's methods.

Dubbed Sarisa (for surface analysis by resonance ionization of sputtered atoms), the Argonne technique has some similarities to the secondary ion mass spectroscopy (SIMS) approach now used widely by the semiconductor industry. But the Sarisa technique goes further.

Similarities. As with SIMS, the first step in using Sarisa is the bombardment of the surface of a silicon sample with an ion current, which drives off atoms of silicon and any impurities present from the surface. In the SIMS approach, the resulting sputtered flux is analyzed using a mass spectrometer. This technique can detect, for certain elements, levels lower than 1 part per billion; but, says Gruen, its ultimate sensitivity is limited by several fundamental factors.

A major drawback of SIMS is that it can detect only the small fraction of the impurity that comes off in an ionized state, and thus doesn't sample the major component of the impurity that consists primarily of neutral atoms. An added problem with detecting iron in silicon is isobaric interference, because some of the silicon comes off the surface in the form of ionized silicon dimer molecules (two silicon atoms bound together), which have virtually the same mass as the iron ions of interest.

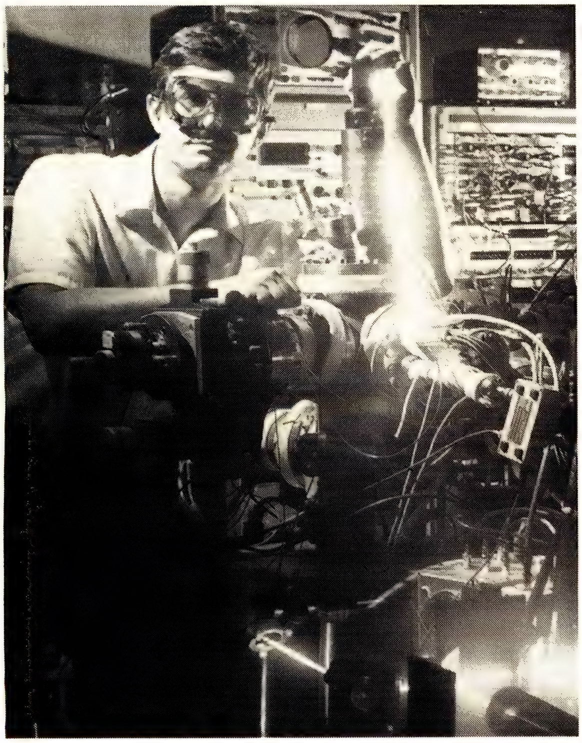
SIMS sensitivity is further decreased because of the relatively low transmission factor—typically about 10^{-3} or 10^{-4}—of mass spectrometers used, Gruen points out. This means that only about 1 in 1,000 or 1 in 10,000 of the already small number (relative to the total sputtered flux) of secondary ions that reach the entrance of the mass spectrometer ever make it to the detector.

Fine tuned. The Sarisa approach overcomes these problems by relying on lasers to ionize elements of interest in the sputtered flux. Key to the approach is that every element on the periodic table has its own characteristic energy level structure, and will thus absorb only certain wavelengths of light. So, by properly tuning laser wavelengths, an atom of a particular target element can be excited without affecting other atoms, including silicon, in the flux.

Argonne researchers use argon ions accelerated to 3 kV as the sputtering source. For the detection of iron, the resulting flux is then zapped with a neodynium-yttrium-aluminum-garnet pumped-dye laser tuned to 302.065 nm, a wavelength that is absorbed by neutral iron atoms. These atoms are then excited further by simultaneous exposure to a second laser—a xenon chloride excimer laser tuned to 308 nm. This causes the iron atoms to throw off an electron, thus leaving a charged particle or ion that is attracted by a negatively charged grid into a detector for counting. Though Argonne has focused on iron to date, officials say virtually any element could be detected with Sarisa by properly tuning the laser wavelengths.

Compared to SIMS, which cannot detect neutral atoms of an impurity in the sputtered flux, an advantage of the Sarisa approach, say Argonne researchers, is that 100% of the neutral ground-state atoms of interest can be ionized and counted. This means that a wafer surface can be nondestructively tested, because only a relatively small amount of bombardment is required to get an adequate sample flux.

A destructive method. By way of contrast, SIMS requires a great deal more sputtering and, as Gruen puts it, "the surface of the sample gets chewed up to the point where you change the surface composition and structure." In addition, the Sarisa approach does away with the need for a mass spectrometer, which eliminates isobaric interference problems caused by silicon dimers as well as inefficiencies caused by low



Bright idea. To measure iron-impurity levels in silicon, the Argonne lab bombards samples with lasers tuned to excite iron atoms, producing charged ions that can be readily detected.

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William Thomson, Lord Kelvin
British Mathematician and Physicist, 1894

Photo Courtesy of National Museums, Paris.

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spectrometer transmission.

Further enhancements to the Sarisa technique may include the use of a commercially available liquid-metal ion source instead of the argon ion source currently used. Compared to the argon source, a liquid-metal ion source offers a much more sharply defined ion beam and could result in lateral spatial resolution on the order of a few hundred angstroms, says Gruen. This could enable the user to scan the surface of a wafer and develop an impurity map that could then be correlated with failures down to the individual junction level on fine-line devices. Lateral spacial resolution using an argon source is limited to between 20 and 30 μm.

Officials of at least one major chip house are impressed. Mark Anthony, a technical staff member in the materials characterization branch at Texas Instruments Inc.'s Central Research Laboratories in Dallas, says that his group hopes to win internal funding to develop a machine based on the Argonne approach for evaluation as a potential production-line system.

Following VLSI down. If the idea proves feasible and cost effective, such a system might used be at the front end of a fabrication line, for example, for impurity characterization sampling of incoming wafers. The Argonne approach "allows us to see impurity levels that we just can't see with any other technique," says Anthony. "It's really the only technique I'm aware of that has the potential to follow VLSI down into 1-micron geometries and very thin films and be able to look at impurity concentrations on the order of parts per billion."

Anthony notes that at least one other organization has a similar system in development. Atom Sciences Inc., based in Oak Ridge, Tenn., and a spin-off from the DOE's Oak Ridge National Laboratory, is working to commercialize technology developed there and on its own since the firm was founded in 1981.

Atom Sciences has several basic patents in the field and has recently begun offering a materials-analysis service to outsiders using a machine that it has in house, says Norbert Thonnard, director of technology at the firm. **–Wesley R. Iversen**

News briefs

Intel LAN chip has 1-2 (Mb/s) punch

After leading with its left at several recent local-area-network standards meetings of the Institute of Electrical and Electronics Engineers, Intel Corp., of Santa Clara, Calif., threw its right last week by introducing a new chip that offers both encoding/decoding and network-interface circuitry for low-speed LANs. Intel has tried three times to have 1- and 2-Mb/s versions of a carrier-sense multiple-access/collision-detection protocol adapted by IEEE committee 802.3. Each try has come a little closer, but its proposal is still under evaluation. Now Intel is introducing a CSMA/CD chip that performs all network access functions outlined in its proposed standard. The chip, called the 82588, performs Manchester encoding for Ethernet-type baseband nets at 1 Mb/s and non-return-to-zero-inverted encoding for 2-Mb/s broadband nets such as the new PC-Net designed by Sytek, Inc., of Mountain View, Calif., for the IBM Personal Computer AT. It also performs all the network interface functions that require a second chip to implement the current 10-Mb/s CSMA standard.

Hitachi using gate array in SRAM

Gate-array technology is becoming too valuable to be used for random logic alone, reasons Hitachi Ltd. So the firm is developing a 24,000-gate-equivalent array processor chip that includes 18,000 gates and two 2,300-bit static random-access memories. Each memory section is configured as 64 words by 36 bits, making it suitable for general registers of a processor—an organization similar to a smaller Toshiba array [*ElectronicsWeek,* Dec. 3, 1984, p. 29]. Propagation delay time for the gates is only 1 ns, and access time for the SRAMs only 10 ns. Hitachi's device will first be used in an in-house system expected in late 1985 or early 1986.

Sperry makes new thrust in computers

If Sperry Corp. goes out of the computer business, it will be in a blaze of glory. Last week, the New York-based company outlined ambitious and aggressive product and marketing plans for its Information Systems Group, which concentrates on commercial computer products. The company will use both its proprietary OS/1100 and industry-standard (meaning primarily IBM Corp. and AT&T Bell Laboratories' Unix) system software and communications in this thrust to become product rich. A processor chip set implemented in Sperry's CMOS III, 1.2-μm technology will be used for its Swift family of machines that performs from 1 million to 8 million instructions per second. A follow-on chip set in a new submicron CMOS IV will be used for a Saturn family of 5-to-18-mips products. Two bipolar technologies—a multichip module as the prime thrust and a multilayer module as a backup hedge—are in parallel development as candidates for the 25-to-100-mips mainframe and supercomputer Mercury family for the 1990s.

The Automation Forum cuts a wide swath

A group of American executives recently formed The Automation Forum to act as a clearinghouse for success stories, forecasts, and statistics on leading manufacturing trends (see story on p.17). Seven trade groups, representing a range of businesses from computer houses to machine-tool builders, are pooling their efforts to cut across the special interests of any one U.S. industry, says William Rolland, of the National Electrical Manufacturers Association, Washington, which spearheaded the effort earlier this year with seed money.

Infrared connections could replace cables

Wider use of infrared technology to supplant cables is possible soon. Becos Industries Inc., of Campbell, Calif., has developed a pair of small boxes that plug into the RS-232-C connector found on most personal computers and printers and communicate using diffused radiation. Capacity is 99 channels at data-transfer speeds up to 400,000 b/s. Becos has priced the product at about $200 in large quantities and plans to release it in March.

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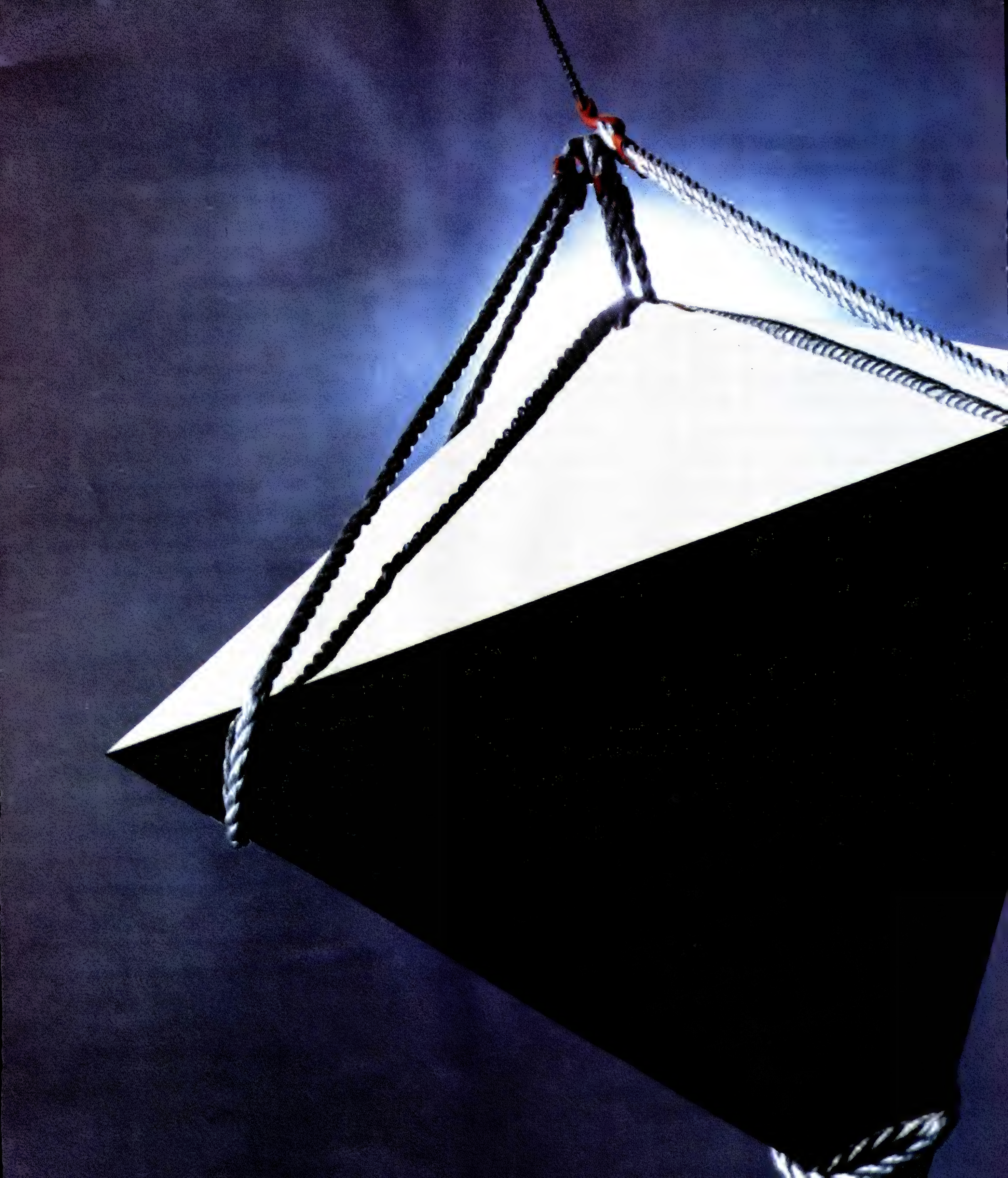

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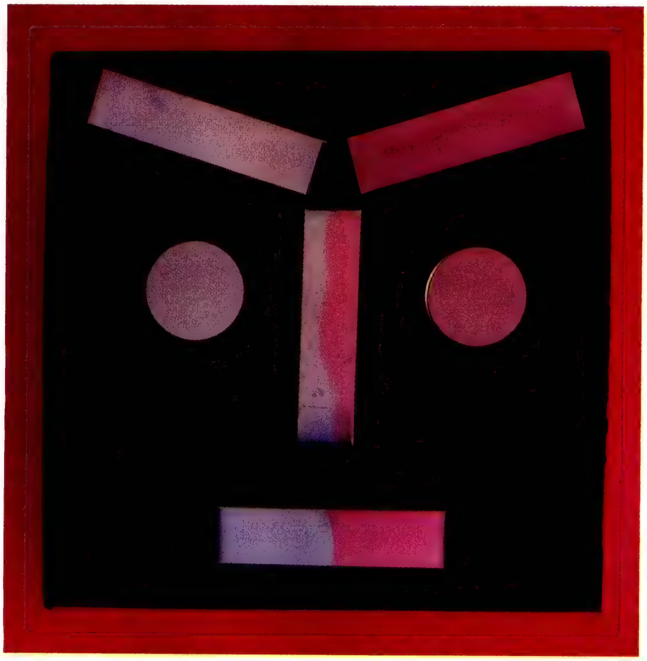
OPTICAL-DISK ALLOY TURNS PINK OR SILVER

Hitachi City, Japan—In their search for a material that will work well for erasable optical disks, engineering-materials specialists at Hitachi Ltd.'s Research Laboratory here have turned to a technology mastered centuries ago by the country's Samurai sword makers: quenching and tempering metal.

Just as the ancient swordsmiths wrought changes in the metal's crystalline structure to obtain a hard cutting edge on a flexible blade, the Hitachi researchers are rearranging the crystalline structure of a thin-film alloy used for recording. But their goal is a reversible color change that can be used to represent logical 1 or 0 data on erasable optical disks.



Reversible color. Silver-zinc alloy changes color from silver to pink when it is heated to 300°C and then cooled down. The color can be changed back to silver by reheating to 100°C.

The Hitachi team, headed by Masateru Suwa, manager of the Laboratory's 5th Department, has been looking at thin films of binary and ternary alloys that exhibit reversible color change depending on the thermal history of the film. One such material is a silver-zinc alloy containing about 35% to 40% zinc by weight.

The alloy is silvery white when deposited or sputtered on a glass substrate. It can be changed to pink by heating it above the 300°C recording temperature for this alloy, and then rapidly cooling, or quenching, it. The reflectivity of the two colors is different enough so that the disk can be read out with a low-power monochromatic laser beam.

Reversible. Erasing is performed by heating the film above 100°C and then slowly cooling, or tempering, it (see diagram, p. 30). Suwa points out that many other materials change color with temperature, but these new alloys are the first for which the change is reversible.

Putting together a system to exploit the alloy media figures to be comparatively simple. A thin film of a binary or ternary alloy is deposited on the disk. Writing is performed with a short laser pulse from a commercial 800-nm semiconductor laser with a power output of 20 to 30 mW. Only the small area of about 1 micron in diameter upon which the beam impinges is heated. Because the surrounding area remains cool, the written area is rapidly cooled, quenching it.

Erasure is performed by a longer pulse of somewhat lower power that may also be defocused. The longer pulse permits heat to flow to the region surrounding the area under the laser spot, and the erased area is slowly cooled at the end of the pulse.

Advantages of these disks over those using the currently popular magneto-optic effect [*Electronics-Week,* Oct. 22, 1984, p. 17] include simpler systems, higher access speed, and potentially lower error rate. Simplicity would be improved because a magnetic head is not required and the readout signal is easier to detect.

Color change on the disks produces a change in power reflected from the disk, while with magneto-optical disks a complex system is needed to detect a small change in the polarization angle of the reflected beam. Access speed is faster because there is no need for a magnet, which increases the moving mass and thus slows down positioning speed. Error rate is potentially lower because the easier-to-detect signal should have a better noise margin.

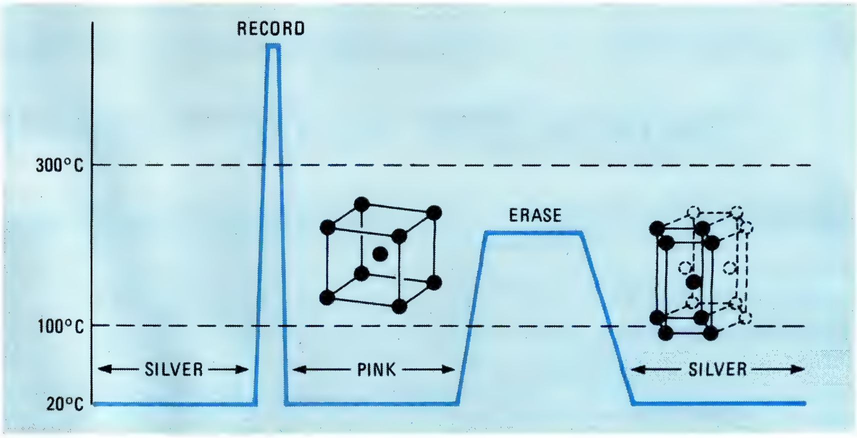
Until now, the closest type of materials system to Hitachi's was the proprietary amorphous-crystalline-transition process of Energy Conversion Devices in Troy, Mich., which a number of firms, including Matsushita Electric Industrial Co., are in the process of developing [*Electronics,* April 7, 1983, p. 75].

Typically, these disks have a film that is initially amorphous but becomes crystalline after heat treatment to provide higher reflectivity. Writing with a short pulse from a laser beam and rapid cooling converts the written spot to an amorphous phase, which has a lower reflectivity.

Erasing is performed by reheating the film with a long pulse from a slightly defocused laser and then cooling it slowly, converting the material back to the crystalline phase. Conversion to the crystalline phase is a form of annealing that proceeds even at low temperatures, and consequently life of recorded information may be a problem for this type of disk.

Changed structure. The Hitachi metal alloy system features a crystal-to-crystal transition. The Ag-Zn alloy has a hexagonal structure in its silver state and an ordered cubic structure in its pink state. Both states are stable at temperatures below 100°C, and no long-term effects are expected. Another alloy being investigated is a silver-aluminum-copper alloy with 7% to 8% aluminum and about 8% copper. This material has an erase temperature of 200°C and a writing temperature of 550°C.

Suwa says that no degradation of experimental films has been found during repeated write-and-erase cycles. Conversion from the recorded condition to the erased condition during storage does not appear to be a problem for temperatures below the erase temperature. Still, Suwa thinks that it may take perhaps three to four years to develop a product because of difficulties in selecting the optimum material, process, and substrate. –**Charles L. Cohen**



Rearranged atoms. When silver-zinc alloy is heated to 300°C, its crystal structure changes from a hexagonal to an ordered cubic state, which appears pink. By reheating to 100°C, the structure can be changed back to hexagonal, which has a silver appearance.

SUPERCOMPUTERS

NSA SEEKS SUPER PARALLEL PROCESSORS

Washington—Not satisfied with the pace of supercomputer research and development activities in either the private or public sectors, the federal government's top-secret National Security Agency plans to build a $12 million Supercomputing Research Center in nearby Prince George's County, Md., to serve its need for machines that will pack 1,000 to 10,000 times more power than what is currently available.

The center's research efforts will focus exclusively on massively parallel architectures for numeric, character, and binary data processing, reports Charles Bostick, an NSA mathematician charged with managing the project. The agency believes "parallel designs must be explored as the answer to the physical speed limitations on current device technologies," he explains.

Integers. Though declining to detail applications the center will support, Bostick says they typically involve searching huge data bases and doing integer calculations. By contrast, the majority of federal supercomputing tasks, including those of the National Aeronautics and Space Administration and the Department of Energy, call for massive amounts of floating-point arithmetic. That is why the NSA feels it cannot rely on the more vector-oriented research directions of other agencies.

Presumably, the NSA needs greater processing speeds to "develop the extremely elaborate schemes used to encrypt and decrypt secret messages, and keep ahead of the enemy's ability to break and decipher those codes," observes Randolph Graves, director of NASA's aerodynamic supercomputing program.

Programs in parallel. The center's contribution to general-purpose multiprocessor development will be to stimulate programmers to write in parallel, believes Geoffrey Fox, a professor at California Institute of Technology in Pasadena, Calif. Fox is in charge of the school's "hyper cube" project to link 1,000 Motorola 68020 processors to achieve performance in the 5- to 10-gigaflops range. The biggest obstacle to commercial production of massively parallel machines is not hardware, but rather "the lack of enthusiasm and interest among programmers to support them with a library of diverse software," he argues.

The center "is really going to be great. It's going to fill in all remaining R&D gaps," adds Charles Fields, deputy director of Strategic Computing Applications for the Defense Advanced Research Projects Agency (Darpa). Whereas NSA's focus overlaps with traditional supercomputer jobs, Darpa's Strategic Computing Initiative is interested in an entirely new realm of applications based on artificial-intelligence technology, he explains.

NSA's Bostick says the center intends to build "a diverse range of massively parallel machines and compare their performance side by side." Although "supercomputer manufacturers and universities are investing in one design, we envision having three to five different configurations up and running all the time."

Bostick declines to say how much the center will spend to support those projects, but industry experts estimate the cost of designing prototypes at a few million dollars each, while production of a massively parallel design would be close to $100 million. The job of the center's staff of 100 will be to identify the most promising designs, award contracts for prototypes, and then run algorithms developed in house as well as applications and benchmarks.

The tests will be used to find ways to boost each prototype's performance to its maximum. During the next two years, the staff will decide on the criteria for selecting projects and setting systems parameters.

Although the center will operate as a secure facility to conduct classified research, it will regularly stage open symposiums and seminars for the academic and commercial communities. –**Karen Berney**

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2N6798	IRFF230	0.4	/557	T0-39
2N6800	IRFF330	1.0	/557	T0-39
2N6802	IRFF430	1.5	/557	T0-39
2N6756	IRF130	0.18	/542A	T0-3
2N6758	IRF230	0.4	/542A	T0-3
2N6760	IRF330	1.0	/542A	T0-3
2N6762	IRF430	1.5	/542A	T0-3
2N6764	IRF150	0.055	/543A	T0-3
2N6766	IRF250	0.085	/543A	T0-3
2N6768	IRF350	0.3	/543A	T0-3
2N6770	IRF450	0.4	/543A	T0-3

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ITALIANS HOPE NEIGHBORS WILL BUY THEIR GEAR

Milan, Italy—Realized without fanfare and perhaps obscured by the commotion surrounding the analogous Franco-German project, Italy has developed a second-generation cellular radio-telephone system, designated the 101 H, that is already field-tested, qualified, and slated to go into service before year-end.

And if Italtel Società Italiana Telecomunicazioni SpA, the company that put it all together, has its way, use of the system will extend beyond the Italian borders. The company is trying to capitalize on the disarray in the Franco-German project [*ElectronicsWeek,* Nov. 26, 1984, p. 8] to sell the system to France as a means of filling the country's pressing need until its project with West Germany bears fruit near the end of the decade in the form of a fully digital system.

The two governments have been unable to establish a common cellular radio-telephone standard and have postponed the project's deadline in order to avoid a complete breakdown. French sources familiar with the state of the country's cellular radio-telephone project have termed the Italtel proposition "a serious alternative."

The attraction of the Italian system is that it already exists and could quickly be put into service to relieve the overpowering demand, particularly in the Paris area. Currently, the city's outmoded mobile-telephone system is saturated with about 1,500 subscribers, a situation that will be only partially relieved when Radiocom 2000, a semicellular system with a capacity of 2,000 subscribers developed by Matra SA, goes into service next year. Italtel could offer capacity for at least 10,000 additional subscribers.

Geographically divided. The 101 H is a 450-MHz mobile cellular radio-telephone system, that, in a given geographical district, allows all subscribers access to the public telephone network through a single interface and control center. When the Italian network is completed in 1987, the country, including Sicily and Sardinia, will consist of 10 such areas, most of them further broken down into several subdivisions. Nationwide capacity will be in the neighborhood of 100,000 subscribers.

Only the second 450-MHz system to go on the air in Europe (the first was the Scandinavian Nordic net started up in mid-1984), the Italtel system's operation is based on a dedicated calling channel and is completely automatic for both incoming (to the subscriber) and outgoing calls. It keeps constant track of subscriber locations with a polling system, so that reaching a given subscriber anywhere in the country is as simple as dialing 0333 plus his number.

Housed at a designated telephone exchange, the 101 H's control center interfaces with the public network on one side and with both a radio base station and a call transmission station on the other. This equipment can theoretically work with any exchange. In Italy, it will be connected to Italtel's own switch, as well as to those produced by domestic subsidiaries of ITT Corp. and Sweden's L.M. Ericsson.

Trunk line. As with other cellular radio systems, the subscriber equipment consists of a transceiver mounted in the trunk and a control head/handset installed on the dashboard. So that its gear would stand up to road conditions, Italtel built it around large-scale integrated circuits and thick-film hybrid circuits.

So far, only Italtel produces the subscriber equipment, although others, such as Telettra SpA and the ITT Corp. subsidiary Face Standard SpA, will almost certainly join the fray soon.

Società Italiana per l'Esercizio Telefonico (SIP), the Italian telephone company, expects to connect some 3,000 subscribers in 1985, a figure that Italtel terms conservative and expects to see increased due to market pressure. Service will begin in Rome, followed shortly by Milan and the regions surrounding the highway connecting those two metropolises.

–**Robert T. Gallagher**

On the road. The subscriber control head for Italtel's cellular radio telephone is driven by a ruggedized transceiver unit installed in the automobile's trunk.

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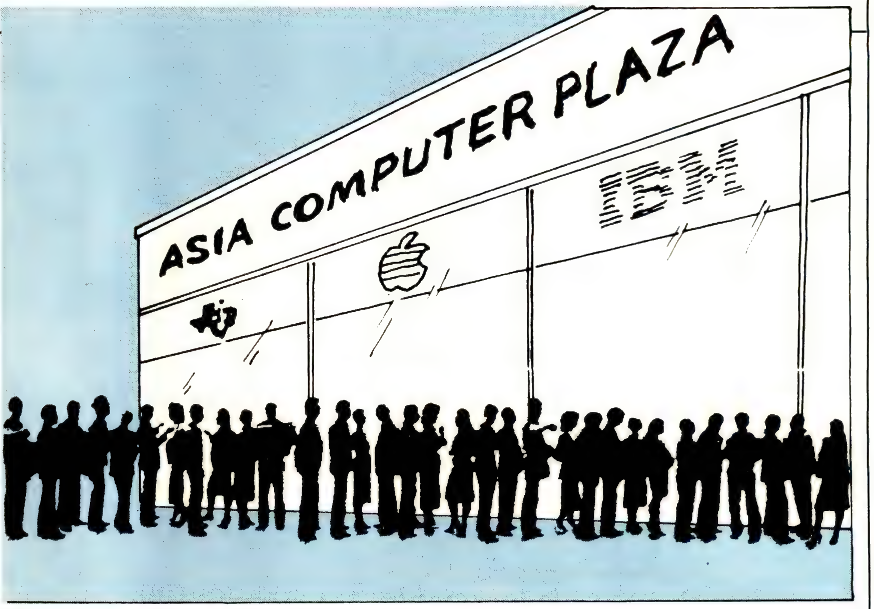
ASIAN ENTREPRENEUR OPENS IN HONG KONG



Hong Kong—Would-be operators of U.S. computer mart complexes have been (and still are) writing advertisements for themselves, but have not yet actually opened for business. Meanwhile, a Hong Kong entrepreneur, Tony Payne, has successfully started up his Asia Computer Plaza in Tsimshatsui, Kowloon, Hong Kong.

Payne, a Hong Kong entrepreneur since 1955, figured that the many small businessmen and professionals in the British colony, as well as affluent individuals from the surrounding region, needed a one-stop shopping mart for computers and communications gear. So he started planning the 50,000-ft^2 plaza early this year and opened it at the end of November with more than 24 self-contained shops operated by independent computer system vendors.

More than hardware. Computer Plaza Ltd., operator of the plaza, provides telephones and an answering service along with an exhibition floor, conference room, and seminar or training room. The management also conducts basic training and education programs, sponsors weekly exhibits, and runs a users' club.

These services are similar to the plans of the big U.S. computer marts such as Infomart in Dallas [*Electronics,* Feb. 10, 1982, p. 111]. Infomart, scheduled to open on Jan. 21, 1985, will have 202,000 ft^2 of room for vendors' stores in a building having more than 1 million ft^2 of floor space. Another well-publicized venture is Boscom, at Commonwealth Pier 5 on the Boston waterfront, which will open late in 1985. Other computer marts are planned for New York, Atlanta, Santa Clara, Calif., Paris, and Frankfurt.

A forerunner for these full-fledged marts, the Business Products Center, opened early in 1981 in a 39,000-ft^2 section of the Merchandise Mart in Chicago. It currently has eight vendor shops, including Texas Instruments, Control Data, Monroe Systems for Business, Honeywell, and Digital Equipment Corp. The Illinois Software Center that is operated by the state-supported Illinois Software Association has just opened in the Merchandise Mart.

The key idea behind computer marts is similar to marts for other products: to provide a centralized, comfortable facility for prospective buyers to see and try products from many vendors. The Asia Computer Plaza has shops for such well-known U.S. brands as Apple, IBM, Texas Instruments, Compaq, Altos, Convergent Technologies, Burroughs, and Data General, as well as many other local and imported brands.

In addition, a company called Communication Services Ltd., a subsidiary of the Hong Kong Telephone Co. in the British Crown Colony, has a shop that sells terminals, modems, telephones, and other data-communications products in its shop.

Three's a crowd. Payne believes that the Hong Kong computer market is likely to be roughly divided by three; one third for Apple Computer Inc., one third for IBM Corp., and the remainder for all the rest—whom Payne calls the one-percenters, because they will each have market shares about that size.

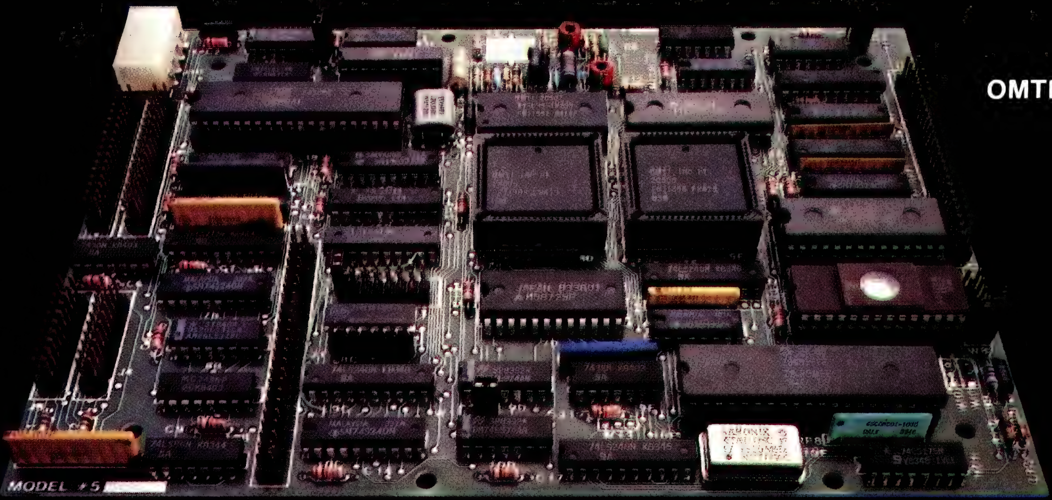
Like the Asia Computer Plaza, the two big computer marts to open next year in the U.S. have signed up the major makers plus a host of smaller vendors. Infomart in Dallas now has total commitments for about 65% of its space from about 90 vendors. Meanwhile, Boscom has more than 100,000 ft^2 signed up.

The Hong Kong, Dallas, and Boston mart managers have all determined that the vendors generally want more than just space for a shop. The vendors also want the mart to attract qualified traffic through conferences, exhibitions, and meetings that are organized by the mart management—activities that these three marts are going to provide.

Many companies feel that the mart concept is one effective way to reach the single-machine and small-system buyers at an affordable sales cost; the profits on personal computers and small systems are too low to support field calls by salesmen.

No one yet knows if the mart idea could catch on in a big way; it is far too early to tell. And so far, the mart concept is regional in outlook. No one is thinking in terms of a big national mart or large chains of marts. However, the builder of Infomart—the Dallas Market Center, which is owned by the family of Dallas real-estate developer Trammell Crow—will be the developer for the New York, Paris, and Frankfurt marts. –**Tom Manuel**

All on one board



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NEC NEWSCOPE

V-SERIES CMOS MICROPROCESSORS

NEC has unveiled the V-Series, a superior species of 16/32-bit CMOS microprocessors.

Ready for your evaluation are V20 and V30 16-bit microprocessors. The V20 has an 8-bit external bus, while the V30 is a full 16-bit machine. A powerful set of 101 instructions, dual data bus architecture and many other design refinements make these chips 50% faster than our 16-bit NMOS processors. Also power consumption is reduced by 70%.

The V20/V30 are supported by a full range of CMOS peripherals. A CMOS coprocessor (Floating Point Processor) is under development. The software package includes a proprietary real time OS, and development tools include an in-circuit emulator, relocatable assembler, Pascal and C compilers.

Shortly, peripherals hop on board. The V40 and V50 feature basic peripheral functions integrated on V20 and V30 silicon. The V25, complete with ROM, RAM, I/O port and serial interface, is a powerful processor for portable products.

The V20~V50 give you higher performance utilizing current software developed for our NMOS micros.

The V60 and V70 are 32-bit microprocessors with mainframe power. Features include an on-chip memory management unit and 4.3-gigabyte virtual memory.

The V-Series is second-sourced by Zilog, Inc.

C&C
Computers and Communications

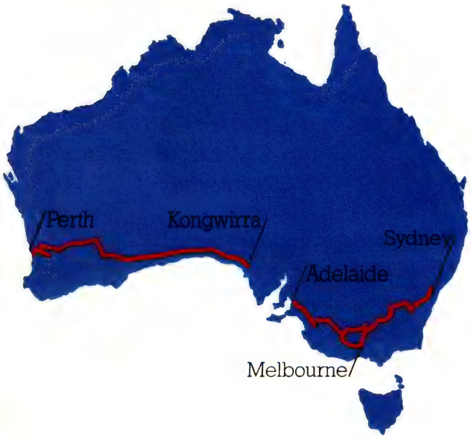
NUMBER 132

LARGE DIGITAL MICROWAVE LINK TO AUSTRALIA

NEC will supply Australia with a third large-capacity digital microwave system. Based on NEC's advanced 500-Series, it will span a total distance of 2,000km between Perth and Kongwirra in 52 hops.

This new link will use NEC's 6.7GHz 140MB equipment with a capacity of 3,840 telephone channels, currently the largest available. The equipment is specially designed to operate in high temperatures, which top 55°C in the desert regions during the summer. Numerous advanced features, including adaptive and transversal equalizers and hitless switchover equipment, are incorporated to assure high speech quality.

The two previously supplied digital links are the 800km Sydney-Melbourne system and 650km Melbourne-Adelaide system. These also feature NEC's 500-Series 140MB equipment and accommodate 11,520 telephone channels.



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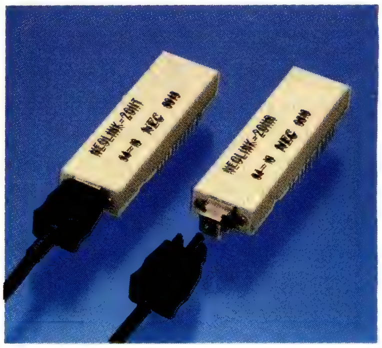


The NEOLINK-2011 combines a 1.3μm high-speed LED and PIN-PD. This ideal configuration takes maximum advantage of the low-loss, low-dispersion regions of graded index fibers.

The surface-emitting LED features 1.8ns rise and fall times and requires no thermoelectric cooling device. A newly-developed monolithic IC in the receiver incorporates AGC and line failure detection circuits and secures a 15 dB dynamic range. As a result, dependable high-speed digital transmission of up to 200Mb/s over a maximum distance of 3km is possible.

NEC's NEOLINK-2011 mates with graded index fibers of diverse core diameters. Interfacing with other systems is made easy by ECL level input/output and minimal restrictions on data formats.

The 9.5mm-high DIP design can be mounted directly on PC boards and runs on a −5.2V DC power supply. The built-in AGC eliminates circuit adjustments.

A low-profile, low-loss connector, with vibration-resistant lock, provides convenient snap-on connection.

NEC also supplies optical switches, couplers, fibers and all other components for LAN systems.

NEOLINK is a trademark of NEC Corporation.

THAILAND SELECTS MORE NEAX61 DIGITAL SWITCHING SYSTEMS

The Telephone Organization of Thailand (TOT) has again chosen the NEAX61 digital switching system. This time as the core of its fifth five-year telecommunications expansion project.

The contracts involve more than 870,000 subscriber lines (except for tandem switches) to expand the present digital network with new exchanges, including remote and cabin switches. When these new exchanges begin service, over two million subscriber lines will be served by NEC systems in Thailand.

The digital telephone network in Thailand features NCOM—NEC's Computerized Operation and Maintenance System. Incorporating the best of NEC's long experience and integrated computers and communications (C & C) technologies, NCOM provides comprehensive support using computers for the digital network—an important step towards the goal of ISDN.

NEC
NEC Corporation
Tokyo, Japan

PABX SUPPLIERS QUITTING BRAZIL

New law limiting the digital PABX business to all-Brazilian firms will force foreign suppliers to pull out

☐ *By Rik Turner, McGraw-Hill World News*

São Paulo, Brazil

Four of the world's largest electronics companies have been legislated out of Brazil's $100 million private digital switch market, and one of them, General Telephone and Electronics, is already seeking to sell off its partly held telecommunications operation here.

The legislation, which passed through the country's Congress in October, extends the powers of the highly nationalistic Special Secretariat for Informatics (SEI) to a sector hitherto controlled by the more flexible Ministry of Communications (Minicom).

In an effort to bring local capital into telecommunications, Minicom stipulated in the late 1970s that private automated branch exchanges and key systems could be manufactured in the country only by companies with a majority of their voting capital in the hands of Brazilians. The foreign manufacturers complied with this rule by forming associations with Brazilian groups in which the latter had at least 51% of the capital with a right to vote.

The new law, formulated by the military at the SEI, makes digital switches for the private sector part of the market share reserved exclusively for companies with 100% of their voting capital controlled by Brazilians. Furthermore, company officials also expect the restrictions to broaden quickly.

GTE sells out. GTE, based in Stamford, Conn., is negotiating its 49% stake in Brazil's largest supplier of key-system miniswitches, Multitel S.A., headquartered here. The association, which dates from 1982, has between 50% and 60% of the Brazilian market for key systems, according to industry sources; from this solid installed base, it had been planning to launch an attack on the lower end of the PABX market.

But believing that Brazil will limit the market share reserved for nationals to PABXs with up to 1,000 extensions, Multitel is negotiating to buy out its U.S. associate this month, according to its president, Ivan Muller Botelho. Declining to reveal the value of the deal, Botelho says that "GTE will stay out of the Brazilian market for a specified period of time, and will only come back via another association with our group." He added that Multitel will also be the local representative for GTE in other market segments where it can still operate, such as in satellite equipment.

Ericsson's moves. The majority of the voting capital of Ericsson do Brasil Comércio e Indústria S.A. belongs to two local groups: Banco Brasileiro de Descontos S.A. (Bradesco), the country's largest private banking conglomerate, headquartered here, and the Monteiro Aranha group, based in Rio de Janeiro—which also counts among its activities a share of the local Volkswagen subsidiary. Industry sources put the company's market share at some 33% in PABXs and 8.6% in key systems.

Newton Scartezini, head of project planning and coordination at Ericsson, said the São Paulo company had already built and sold a few digital PABXs, "but according to the new law we won't be able to manufacture or sell them here any more." The company also has a key system, developed in Brazil, which came to market this year.

Sources at the company say the Swedish parent will either have to sell its voting capital in the Brazilian subsidiary to its local partners and then maintain no more than a 30% nonvoting share of the total capital, as stipulated by the new law, or else create a separate company for the manufacture of equipment covered by the new law.

No treat for Dutch. Philips has an association with a leading insurance company, Sul América, Companhia Nacional de Seguros S.A., to manufacture PABXs at a factory in Recife, in the northeastern state of Pernambuco. The association bears the name Sul América Philips Telecomunicações S.A. and has some 22.7% of Brazil's PABX market. Sebastião Rosas, head of the group's components, materials and professional products divisions, says only that Philips has been obliged to "reformulate our medium- and long-term plans for Brazil" as a result of the new law.

There is, however, at least one option open to the Dutch conglomerate that its competitors do not enjoy: the law allows wholly or partly owned subsidiaries of foreign companies to manufacture equipment for export whose local market is reserved exclusively for Brazilians. Such operations must be located in either the poor north or northeastern regions of Brazil, where the government wants to encourage development and create jobs.

Sul América Philips fills the bill. Nonetheless, this would mean bidding farewell to its local market share. Rosas added that the group's activities in other market segments are also hit by the new law. Process control systems, medical electronics equipment, and semiconductors are also affected.

Cut off at the NEC. NEC's local operation, NEC do Brasil S.A., is the result of an association with the São Paulo investment bank, Brasilinvest, with around 10% of the PABX market and some 18% in key systems. A source at the company, also headquartered in São Paulo, revealed that in October the SEI, the supreme power in all matters digital, prohibited NEC do Brasil from manufacturing its two electronic switches—the NEAX 12 and NEAX 22.

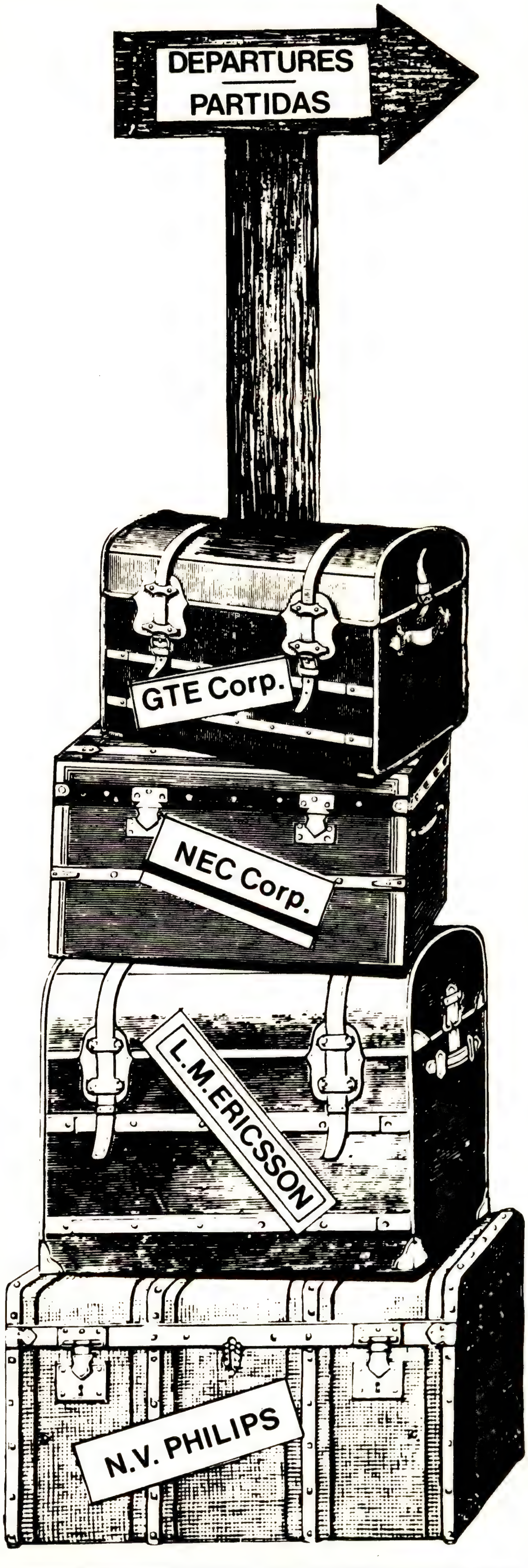
Furthermore, the source revealed that although public switching is not covered by the new law, all imports of digital equipment and components are subject to authorization by the SEI. NEC, Ericsson, and Siemens all have contracts with Minicom for the supply of public exchanges to the state postal and telecommunications authority, Telebrás, and many of their components were being brought in from abroad, which meant application to the SEI for an import license. "Of late, the Secretariat has been demanding unofficially that certain components for central exchanges manufactured by NEC be acquired from local industry. This amounts to between 30% and 50% of one of our public exchanges," complained the source.

Digital switches are not the only area in which the Tokyo firm has had problems in the wake of the new law, however. The source at the company said that also in October the SEI ordered NEC to discontinue the manufacturing of electromechanical facsimile-transfer machines. This creates a *de facto* captive market for the only other option—two electronic models recently launched by Itaú Tecnologia S.A., (Itautec), the computer and automation arm of the second biggest bank, the Banco Itaú S.A., with its headquarters in São Paulo. The Itautec facsimile machine uses technology acquired from NEC's Japanese rival, Canon.

The Siemens São Paulo group has 49% of the voting shares of Equitel Equipamentos e Sistemas de Telecomunicações S.A., São Paulo. The remainder is held by the diversified Hering group from the southern state of Santa Catarina. The company participates in both the PABX and key-systems markets, with shares of 25% and 12%, respectively. A spokesman for Siemens says that both Equitel and another company in the group, Icotron S.A. Indústria de Componentes Eletrônicos, a manufacturer of discrete semiconductors and integrated circuits located in the southernmost state of Rio Grande do Sul, are affected by the new law.

This is by no means the first time Siemens's São Paulo operation has been adversely affected by the SEI's protectionist policies. In 1982, the company decided to sell its numerical-control technology to a local company, Maxitec S.A., when the SEI declared numerical controls out of bounds to foreign companies, and the same local firm absorbed Siemens's programmable-controller technology in 1983 for identical reasons.

Also last year, the extension of the reserved market share to test and measurement, analytical, and biomedical equipment put an end to Siemens's trade in imported ultrasonic devices for doctors, which it had been bringing in from the parent company in West Germany. In consequence, it is no surprise that the president of the Brazilian subsidiary, Helmut Vervuert, has been a frequent critic of government policy in electronics.



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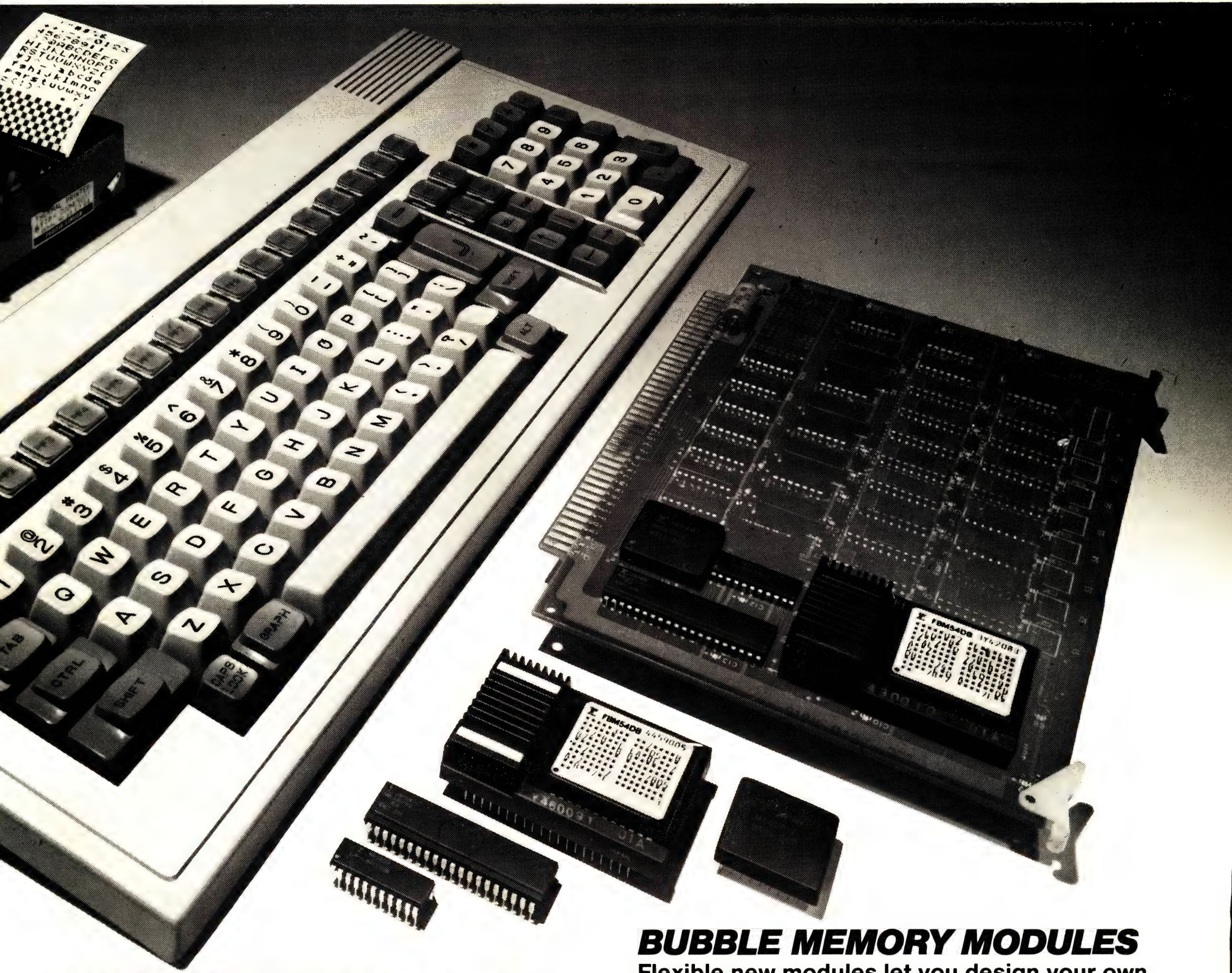

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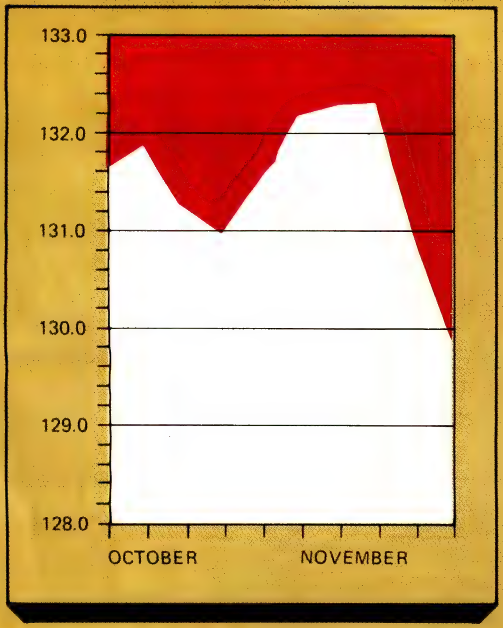
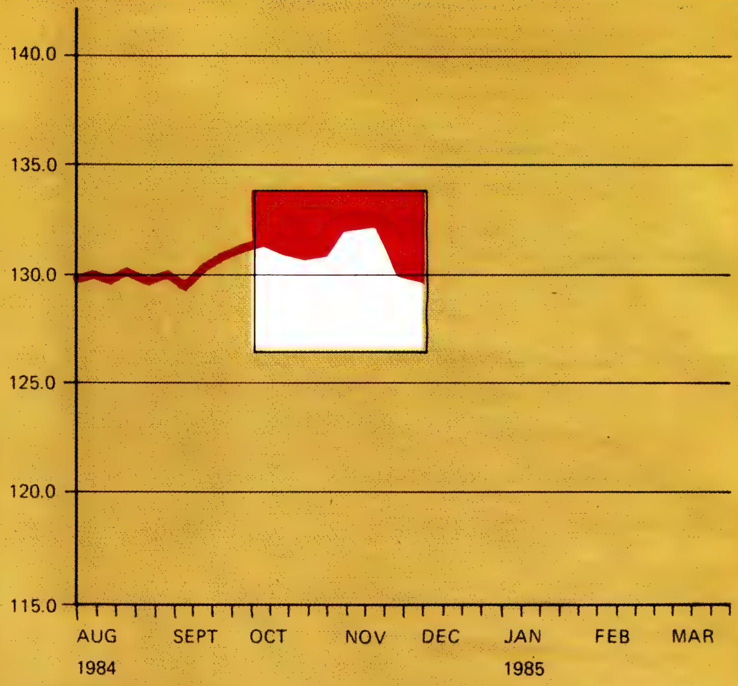


THIS WEEK = 129.8
LAST WEEK = 130.9
YEAR AGO = 103.7
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

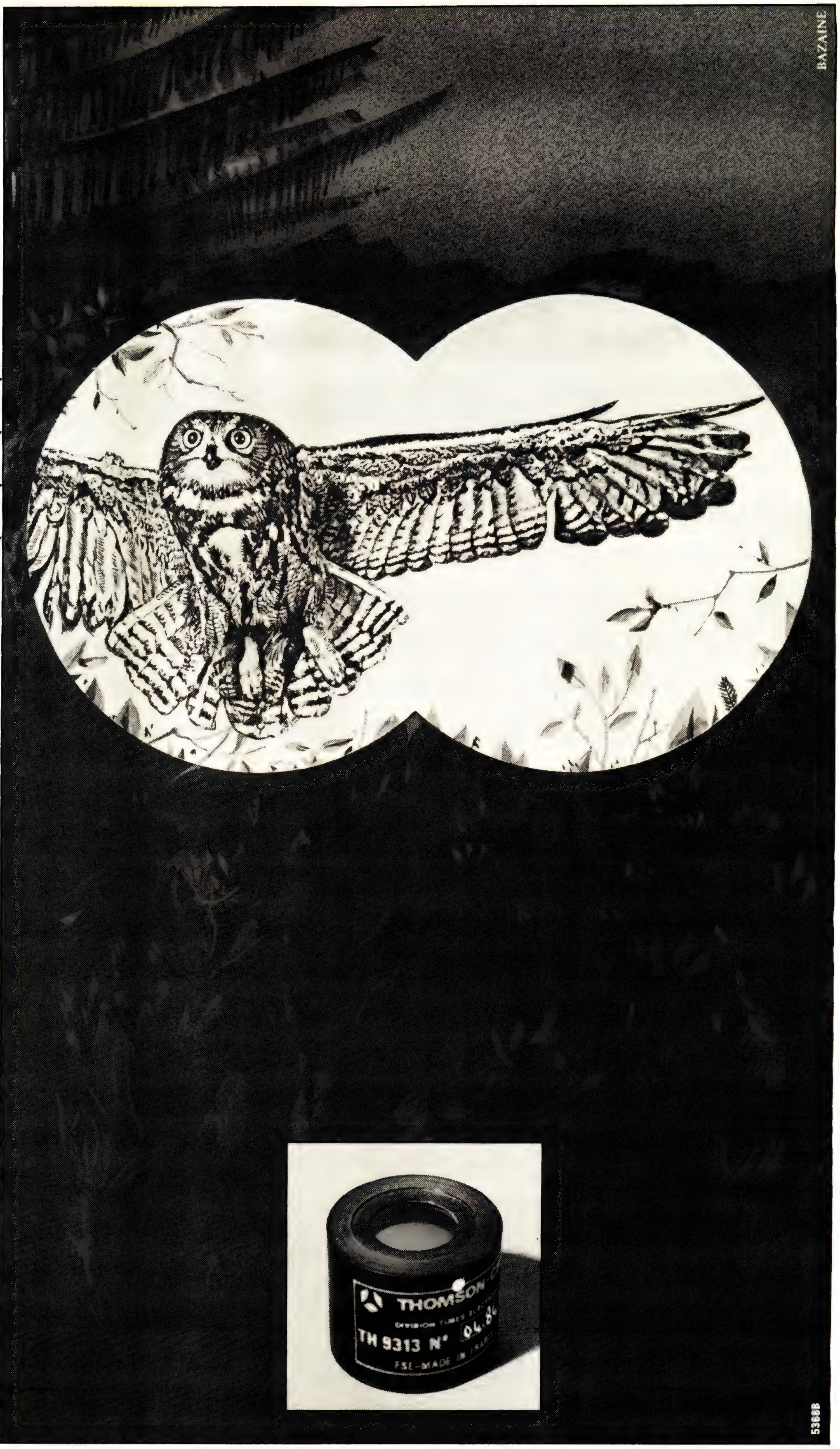
U.S. ELECTRONICS INDUSTRY SHIPMENTS

	October 1984	September 1984	October 1983
Shipments ($ billions) Communications equipment	4.488	4.744	4.119
Radio and TV receiving equipment	0.805	0.832	0.768
Electronic and electrical instruments	4.662	4.838	4.305
Components	3.781	3.973	3.183

U.S. GENERAL ECONOMIC INDICATORS

	October 1984	September 1984	October 1983
Index of leading economic indicators	163.8	165.0	162.4
Budgeted outlays of the federal government ($ billions)	81.037	51.234	70.226
Budgeted outlays of the Department of Defense ($ billions)	20.643	18.942	17.416
Operating rate of all industries (% capacity)	80.3	80.3	77.4
Industrial-production index	165.2	165.2	155.0
Total housing starts (annual rate in thousands)	151.5	167.9	167.2

Shipments of electronic equipment, one of the components of the *ElectronicsWeek* Index, dropped 4.5% in October, according to the latest U.S. government statistics. This brought the Index to its lowest level in almost three months. After coasting neatly through a third quarter fraught with higher import penetration and the U.S. economy's overall lackluster performance, shipments fell across all product lines. Radio and TV shipments were off 3.2%, while shipments of communications gear were down 5.4%.



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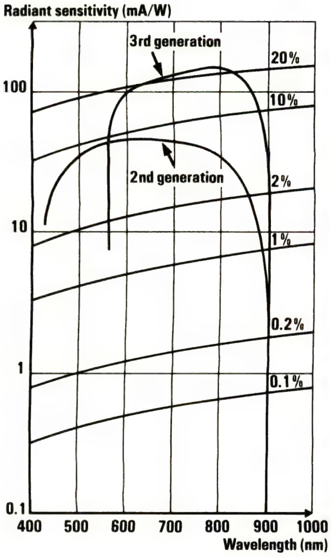

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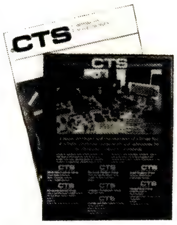

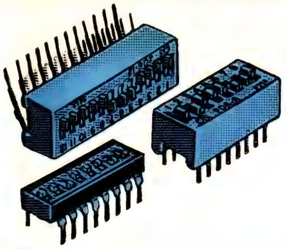

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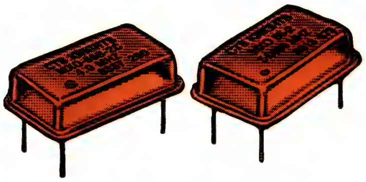

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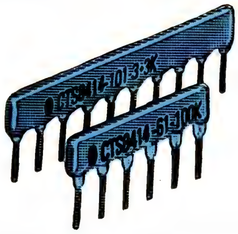

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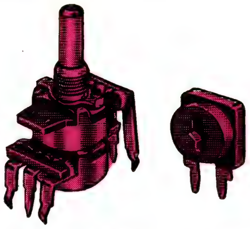

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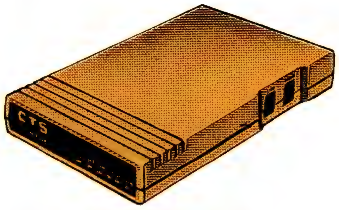

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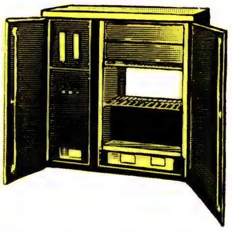

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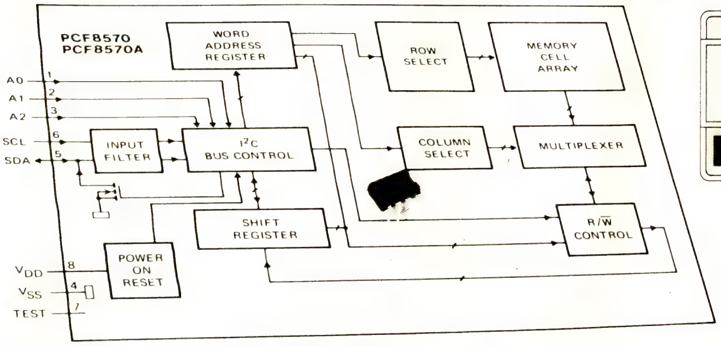

I²C BUS

Our latest I²C bus product, a 256 x 8-bit static RAM, combines low power CMOS performance with a remarkably low pin count. The PCF8570, supplied in an 8-pin DIL package, interfaces with the bi-directional I²C serial bus and thus requires only two pins for data transfer, resulting in considerably simplified interconnection circuitry als well as PCB space savings. The PCF8570 was developed from the well-established PCD8571, a 1 Kbyte RAM. The two ICs share several important features: same software address; identical pinning (three address pins, one test input, two power supply pins); low standby voltage of 1,0 V minimum (ideal for battery back-up operation); power saving mode current of typically 50 nA; operating voltage range of 2,5 to 6,0 V. The PCF8570 is a basic peripheral in I²C bus interfaced systems, such as in telephony, radio and TV, video cassette recorders or general purpose industrial applications. Alternatively, the PCF8570 can be used with any industry standard microcomputer, in which case the I²C bus is implemented in software. Up to eight PCF8570s may be connected to the I²C bus without additional hardware; selection is performed by the hardware address pins. The 8-pin DIL encapsulation is a plastic SOT-97A.

CIRCLE 200 ON READER SERVICE CARD

FSK MODEM CHIP SET FOR LANs PROVIDES TWO MEGABAUD TOKEN-PASSING PERFORMANCE AND COMPLIES WITH IEEE 802.4

Signetics is introducing a two chip set that transmits and receives digital data on Local Area Networks (LANs) at speeds up to 2 Mbaud and complies with the industry standard IEEE 802.4. The new NE5080/NE5081 high-speed FSK modem transmitter and receiver provide a system-level solution for LANs used in either point-to-point or token bus service. First of its kind to be introduced by any manufacturer, the new chip set replaces board-level solutions and thus reduces manufacturing costs while simultaneously offering flexibility in data rates and modes of operation. LANs, used to transmit large quantities of digital data among computer-based equipment in factories, offices and other environments, require efficient methods for error-free data transmission and reception at high speeds. The NE5080/NE5081 chip set offers phase-continuous frequency-shift-keyed modulation and demodulation of a digital bit stream in various network architectures. In point-to-point service, for example, the chip set can implement a one-half megabit/second full duplex data link between computers as far apart as 15 km. This capability is useful in large installations such as power plants or oil refineries. Variations of this architecture allow construction of local networks for large ships, aircraft and other forms of transportation. One of the most popular uses for the new NE5080/NE5081 is in token bus architectures conforming to the (U.S.) IEEE 802.4. This industry-wide standard calls for a single channel phase-continuous FSK bus and is most relevant for the construction of local networks consisting of many computers which share data buses, printers, plotters and other computer peripherals. Networks of this type are common in office, factory and campus settings and are proliferating rapidly as automation, robotics and personal computers penetrate all aspects of modern life. The new chip set not only conforms to the 802.4 standard but also permits design engineers to tailor performance to suit individual requirements in data rate, carrier frequency and type of cable used to carry transmission. The NE5080 is housed in a 16-pin plastic DIL, the NE5081 is a 20-pin plastic DIL. Both ICs are rated for operation across the commercial temperature range (0 to 70 °C). The NE5080 operates from a single +5 V supply and dissipates 375 mW; the NE5081 also operates from a single +5 V supply and dissipates 250 mW.

CIRCLE 201 ON READER SERVICE CARD

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Latest additions to our range of GTOs are three devices of the BTV60 family. These second generation GTOs have a 120 A repetitive peak controllable anode current rating and voltage ratings of 850 V, 1000 V and 1200 V. The new BTV60 family is characterized by a much finer cathode structure which allows fast, efficient switching at up to three times the power of equivalent first generation GTOs. Like earlier GTOs the BTV60-850, BTV60-1000 and BTV60-1200 combine the best features of both transistors and thyristors, however the second generation GTOs can control much larger motors. In addition, six BTV60s can replace twelve conventional thyristors in PWM a.c. motor control applications. All three types are encapsulated in the versatile TO-238 AA package.

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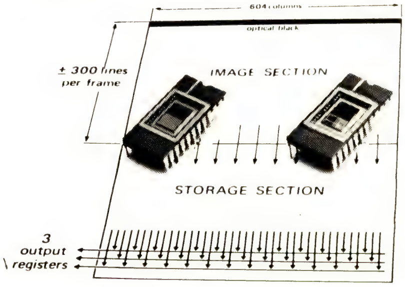

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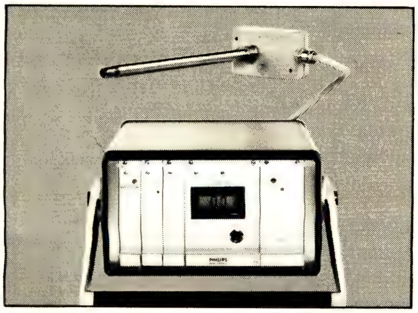

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TELECOM LAWYER WANTS DEREGULATION REGULATED

Washington

Over the last 10 years, Washington has become a mecca for telecommunications attorneys. Herbert Marks is considered by both industry and his peers to be one of the leaders in this field. Now, with the Reagan administration committed to telecommunications deregulation, Marks says he is doing the most interesting work of his career.

Telecom law wasn't always so exciting. Fifteen years ago, when Marks started at the law firm of Squire, Sanders and Dempsey, there was only one telecommunications company: AT&T. "All the government and private-sector representatives could fit into one room and quickly resolve differences," he says. Today, the panoply of issues is such that "every time I think I know who's in the act, another player arrives on the scene."

The common goal is to create a new environment that will sustain a high level of innovation. In turn, that requires making transitional rules "which won't cause severe dislocations in the interim." It is here that the Yale-educated lawyer finds cause for criticism of the Reagan Administration's policies.

Overeager FCC. His overriding concern is the breakneck speed with which the Federal Communications Commission is deregulating telecom markets. With numerous post-AT&T divestiture issues still unsettled and user rates threatening to increase dramatically, Marks can hardly believe that the FCC is considering getting out of the business of setting rates and telephone tariffs.

It's indicative of "the kind of premature relaxation that could defeat the goal we're aiming for." Higher rates will drive businesses into building private networks, thus depriving the phone companies of the revenues that they need to stay technologically competitive, he contends.

Another example: the Carter Justice Department was so quick to divest AT&T that it barely considered the effect on what has made the U.S. telephone system the best in the world—standards. As a result, Marks says, many of his clients are holding back on buying new equipment because they don't know whether it will plug into other manufacturers' brands. The same interconnection problems that are now plaguing the computer industry are destined to characterize telecommunications services.

In the international arena, he also sees the administration tending to break with the past, although not quite as fast, without fully weighing the economic and technological effects of doing so. For example, in late November the FCC enacted new regulations that will pave the way for private satellite networks to compete with Intelsat, the multinational cooperative with a 20-year monopoly on global telecommunications. This time, Marks questions the FCC's wisdom on the grounds "of a current overcapacity in satellite and cable services predicted to grow much worse."

Wants a bigger brother. Telecommunications lawyer Herbert Marks thinks the government should take a firmer regulatory posture during the dislocations following AT&T Co.'s divestiture.

What is even more disturbing to Marks is the two years it took for federal agencies to resolve their quarrels in the telecom arena. "The trend is to de-emphasize the government's role when re-emphasis on government is exactly what is called for to give a coherent focus to international telecom policy." –**Karen Berney**

Evans wants role of West Coast in management of IEEE affairs to grow

Palo Alto

Jane G. Evans will be busier than ever come Jan. 1 when she becomes director of the Institute of Electrical and Electronics Engineers' Region 6. Already busy as the computer grants manager for Hewlett-Packard Co., and currently vice chairman of Region 6, Evans expects she will devote even more time to the IEEE—especially to support continuing education for engineers.

"The IEEE has a major effort in continuing education. I'd like to see Region 6 at the forefront of that," Evans says. She cites seminars and short (one- or two-day) tutorials as examples of the most effective ways to keep engineers up on the state of the art. She is also enthusiastic about the potential of video conferencing for spreading information.

Evans foresees Region 6 becoming more important in the IEEE. Extending from New Mexico to Hawaii, it last year outstripped the Northeast in membership. On that basis, she says, "One of the goals that I have is to persuade the IEEE to have a West Coast base to support the headquarters in New York."

An engineer's story. Starting out with a BS in chemistry from Rice University, Houston, Evans says that "much of my work as a chemist was with electronic instruments." She soon decided that electronics was the more interesting field and moved to the San Francisco Bay area to pursue a BSEE at San Jose State University.

At HP she first worked in applications engineering for setting time and frequency standards with cesium beams. From there, she moved to nuclear instrumentation and learned about computers as the company developed them for instrument control.

Her career seems to be keeping pace with the IEEE's growing West Coast membership and its interest in computers: the IEEE's Computer Society is now its largest subgroup. It also testifies to the necessity of keeping current.

Evans now finds herself working in the same HP building she started in 19 years ago. And although she speaks fondly of the old days, when a clock's chime drew the firm's employees together for leisurely coffee breaks, she appreciates the fast pace that she can achieve with her desktop computer.

New chief. Jane G. Evans, computer grants manager for Hewlett-Packard Co., becomes director of the IEEE's Region 6 on Jan. 1, and hopes to increase its influence.

As computer grants manager, Evans is involved in the company's program of donating computers to universities and organizations. She continues to do some systems engineering in helping to implement large computer gifts once the appropriateness of HP's computer donations has been decided. Although she has taken on much management work with the IEEE as well as with HP, she notes that "engineering is a house of many rooms." **–Eve Bennett**

Smith sees Merit in assisting contractors

Richardson, Texas

With all the new technologies tumbling off the shelf in military electronics markets, equipment designers must take care not to trip up in the early stages of development. So says Sam K. Smith, president of startup Merit Technology Inc., which is homing its sights on providing analysis, modeling, simulation, and engineering services in the advanced defense systems business.

"There is a lot of interest in the power of VHSIC [very high-speed integrated circuits; see related story on p. 57] and artificial intelligence, which can unload many tasks from human operators of a weapons system. But the emerging technologies are also making systems definition much more difficult," notes the 52-year-old Smith, one of Merit Technology's three founders.

Prior to the firm's founding, Smith, who holds a BSEE from the University of Oklahoma, was president and chief executive officer of a fledgling Ada software house, Computer*Thought Corp., in Plano, Texas. Before that, and until 1983, he spent 26 years with Texas Instruments Inc., heading up the firm's Military Equipment Group in Dallas and its computer operation in Austin. Merit Technology's other founders, G. Mel Barney and Dennis J. Gorman, also worked at TI before getting the firm going in September.

The new firm—backed with a couple of million dollars from venture capitalists—is focusing its initial efforts on maximizing leading-edge technologies in the advanced tactical avionics arena, says Smith. To do this, Merit Technology's product portfolio will be filled with nonhardware items, such as algorithms, software, system simulation and integration, testing, and evaluation services.

High-tech go-between. Assisting prime contractors in the design of advanced defense systems is the idea behind Sam K. Smith's startup company.

"It's not necessarily software engineering but other 'soft' kinds of sciences to bring capabilities of system engineering and knowledge of hardware—particularly the VHSIC sorts of things—together," explains Smith.

Nonpartisan view. The intent at Merit Technology is to provide a third-party, nonpartisan view of emerging technologies and to assist prime contractors—as well as defense agencies—in evaluating new, alternative approaches to system design and definitions, Smith says. By providing engineering design and system analysis, Merit Technology can eventually achieve revenues of several hundred million dollars.

Smith says the firm's staff will grow from 10 to about 30 by mid-1985, most of whom will have PhDs. With its assembled expertise, it plans to attack military systems engineering, VHSIC, AI, programming languages (Lisp and Ada), common sensor and module concepts, advanced software, simulation tools, and signal processing. **–J. Robert Lineback**

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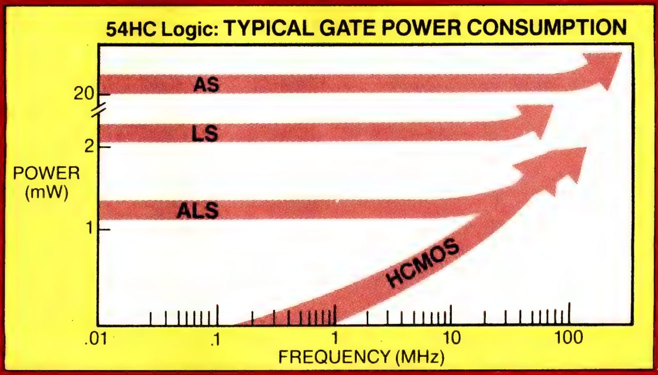

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PC-BASED CAD GEAR THREATENS HIGH-PRICED WORK STATIONS

Los Gatos, Calif.

"Ordinary engineers don't drive Mercedes—they drive Toyotas. And they don't design on expensive work stations. Most of them design with pencil and paper," says Roy Prasad, vice president of Personal CAD Systems Inc., a company here that would like to take away that engineer's pencil box and put him in front of a nice low-cost computer-aided design system built around an IBM Corp. Personal Computer.

These ordinary engineers are just beginning to find out how much CAD capability resides in the IBM PC, adds P-CAD president Richard Nedbal. "Within a year, we will have as many installations as Daisy," Nedbal claims, referring to Daisy Systems Corp., in nearby Santa Clara, a leading maker of CAD work stations. "I grant you, our software is a lot cheaper. But people are finding out that they can really do a lot on a PC. They're not so skeptical any more."

Nedbal claims that his firm's IBM PC-based schematic capture, simulation, and layout software gives engineers 80% of the power of a $50,000 to $100,000 CAD work station at 20% of the price. He cites one test in which an integrated-circuit simulation that took 13.1 s on an IBM 3084 was performed in 4 min by P-CAD software on an IBM PC/AT. "It cost $9,000 to connect to the mainframe and several hours to get the paper printout," Nedbal says. "The PC AT is already faster in terms of turnaround, and $9,000 would have bought the whole P-CAD system."

Nedbal figures that thanks to the Toyota-driving engineers, P-CAD will reach $10 million in sales this year—just two years after its founding—and will triple that figure in 1985. With more than 100 employees, P-CAD is already the largest of the companies specializing in low-end CAD.

All aboard. P-CAD's design automation software is aimed mainly at the printed-circuit-board market, which Dataquest Inc., the San Jose, Calif., market research firm, estimates at about $327 million this year, mounting to $1.167 billion by 1988. Comparable figures for IC layout, the specialty of the high-performance work stations, are $121 million and $604 million. Schematic-capture and simulation software, which P-CAD also sells, will zoom from $317 million to $1.814 billion.

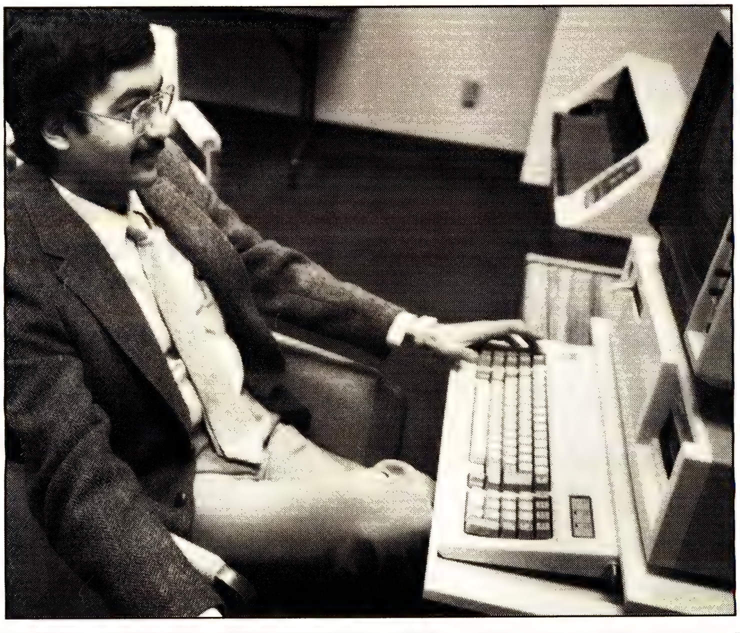
In all, Dataquest says, 12,000 IBM PCs will be used for CAD this year, and 15,000 next. "P-CAD is certainly one of the major players," says analyst Beth Tucker. "They are doing very well, and their figures are quite impressive."

A competitor, Phil King, marketing vice president of Chancellor Computer Corp., Mountain View, Calif., suggests that personal-computer-based CAD systems are a threat to the work station companies. "The big computer-assisted engineering companies have been telling engineers that CAE functions were more computer-intensive than they really are," King says. "Now that we've gotten some low-cost machines with tremendous power, we're seeing the beginning of the end of the work station people. In the near future, you may see one or two holdovers from the work station companies, but some version of the [personal-computer-based] CAD companies will take over."

Scads of CAD. Not likely, Dataquest's Tucker says. "PCs cannot address all the design needs right now," she says. "In addition, I expect to see Daisy, Valid Logic, and Mentor Graphics [the CAE Big Three] coming out with PC-based systems." (Daisy already has one, but it can only be used with the firm's more expensive equipment.)

"P-CAD does have a fully functional system," Tucker concedes, referring to its three CAD components: schematic capture, simulation, and layout. "The majority of users don't need a huge full-blown CAD system, so they [P-CAD] will find a market niche."

But P-CAD expects to have more than a niche when the IBM PC hardware catches up with design-automation software. The PC AT, says Prasad, head of P-CAD's Electronic Design Automa-



Meeting needs. The bulk of working engineers need inexpensive "blue-collar" types of CAD systems, not expensive tools, says Personal CAD's Roy Prasad.

tion Division, has already improved the performance of P-CAD's simulation software by 2½ times. "The XT was marginally adequate. The AT really makes it fly," he says. The firm will soon release utility software, such as a program that performs back-annotation for nonfunctional layout changes.

The company markets its CAD systems through sales representatives. "These are the same people who sell electronic instrumentation to large companies," Nedbal says. "They've never had the opportunity to sell CAD before. Now it's becoming the biggest single revenue generator they have." **–Clifford Barney**

Future is uncertain for Alpha Industries but prospects may not yet be diminished

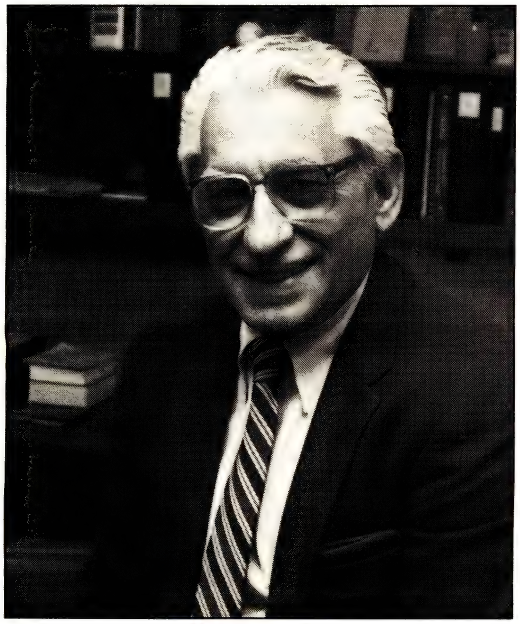
Woburn, Mass.

A month ago, a national business magazine placed Alpha Industries Inc. on a list of up-and-comers—small companies with strong growth records and bright futures. Apparently, that list was compiled some time earlier: these days, Alpha officials are wondering whether the firm is on its way down and out.

What brings Alpha to this precarious point are federal indictments, handed down by a California grand jury in October, alleging the firm and one of its vice presidents were involved in a kickback scheme to secure a subcontract from Raytheon Co., Lexington, Mass. If convicted, Alpha could be barred from doing business with the military, which is responsible for 70% of its sales.

Alpha, a 22-year-old firm here that specializes in microwave technology, recorded just over $60 million in sales last year and now employs about 1,300 people. Its product line includes semiconductors and microwave and millimeter-wave components.

According to the indictments, Alpha paid a Raytheon employee, Chester Adamsky, $57,000 to secure a switch-filter contract. The charges also allege that the parties attempted to disguise the kickback as payment for a marketing study done by a firm owned by Adamsky. The study delivered to Alpha was a version of a report Raytheon had previously prepared for the Navy on FET amplifiers, the indictment says. A trial date has been set for March.


Optimistic. Despite the cloud of a federal indictment for an alleged kickback scheme hanging over its head, Alpha Industries has more potential now than two years ago, thinks president Andrew Kariotis.

No comment. On advice of counsel, Alpha says little about the case but indicates it will maintain in court that it paid for a legitimate marketing study. Meanwhile, the indicted Alpha vice president has been placed on administrative leave. Speaking in general about the question of kickbacks, George Kariotis, Alpha's founder and current chairman, says that despite public perceptions, "the business has been remarkably clean of that sort of thing." Adds president Andrew Kariotis, his brother: "I'll make a prediction. If we're exonerated, it will be on page 38 [of the newspapers] on the bottom with no headline."

A military review panel is considering suspending all business with Alpha because of the indictment, with a decision expected soon. Some observers think the Air Force will deal lightly with the company, which is involved in some 200 military programs and is a sole source in nearly half of those. "In no way does the Air Force want a key supplier like Alpha out of business," says analyst Rick Whittington, of Prudential Bache Securities Inc., New York.

Alpha itself is trying to get the Defense Department "to consider our value as a vendor in considering what to do with us," says George Kariotis. If the Air Force found Alpha's hierarchy was involved in wrongdoing, Whittington thinks, the Pentagon would likely impose a sentence of about six months, "which would probably lead management to sell out." A conviction could lead to Alpha's exclusion from further military contracts.

Another analyst who follows the company describes Alpha's current role in this matter as one of damage control, saying, "Even if they're totally exonerated, there's still that shadow." Already, says Andrew Kariotis, "it's very difficult to hire new [professional] people. Some candidates chose not to come [on board] although it looked like they were going to."

Seller's market. Still, the indictment appears not to have had a dramatic effect on Alpha's business yet. The firm reports that new orders in the second quarter were up 51% over last year, to a record $24.3 million. Also at record levels is Alpha's backlog, which reached $52.2 million. But, says Andrew Kariotis, "it takes a long time to lose business." Besides, "it's a seller's market. There is an undercapacity in the industry in almost all segments."

Lost in the news about the problems are many positive developments, he says, including Alpha's production of silicon monolithic chips and ongoing research and development with gallium arsenide and millimeter-wave technology. "If we had great potential two years ago, we have better potential now," he says. Still, Alpha's profits have stagnated, because of production problems at a microwave component facility in Lawrence, Mass. Asked when these problems might be resolved, Andrew Kariotis says, "I can't say that. I said that before, so I won't say it again." **–Craig D. Rose**

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VHSIC-INSERTION PROGRAM BEGINS TO PAY DIVIDENDS

VHSIC Phase 1 1¼-μm chips will save space, add functions and higher performance to three-service programs

☐ *by Wesley R. Iversen*

After five years and about $340 million worth of development efforts, the U.S. Defense Department's three-service Very High Speed Integrated Circuits (VHSIC) program appears to be rapidly gathering speed toward a payoff later in the decade. Now that working versions of nearly half the 28 chips developed under Phase 1 of the program have appeared—the rest are expected to arrive before the end of 1985—the DOD and military contractors are racing to insert the 1¼-μm technology into weapons systems (figures 1 through 4) even as work gets under way on the next generation of chips.

"Insertion activities are literally booming," declares Jay Patel, associate VHSIC program director, who oversees them at Honeywell Inc., Minneapolis. Already, the Office of the Under Secretary of Defense for Research and Engineering, which is managing the program, has seeded 38 VHSIC Phase 1 insertion programs to the tune of about $150 million. Some are still in the study phase; others have progressed to brassboard demonstration hardware. Certain systems are scheduled for field testing next year.

The three services have put up an additional $300 million to support these contracts, points out E. D. Maynard Jr., VHSIC director in the Office of the Under Secretary of Defense for Research and Engineering. He adds that his office is planning a further $50 million in seed money for more insertion programs.

What's more, the services appear to be embracing the idea of using VHSIC chips in systems that have not been staked with Pentagon money. "The activity is getting to be quite hectic," says Patel, who notes that requests for proposals to develop new weapons systems and upgrades of existing systems that could use VHSIC technology are now coming out more regularly from a variety of military program offices. In fact, contractors report, requests for proposals are beginning to suggest capabilities that could be accomplished only with VHSIC-class technology. As Jesse C. Wilson, deputy program manager for business development at Texas Instruments Inc.'s Equipment Group in Dallas, puts it, "The feeling is that, eventually, nearly all contracts for the services will require VHSIC."

One reason for the fast insertion takeoff is the effort

1. HARM. The High-Speed Anti-Radiation Missile, a joint U.S. Navy-Air Force weapons system, is carried by a U.S. Air Force F-4G Wild Weasel aircraft. Texas Instruments' VHSIC technology is being applied to the HARM's advanced processor.

made by the VHSIC office to encourage program office managers to take a chance on the new technology. Charged with developing new systems, managers on both sides of the industry-service line are caught in a dilemma: how to take advantage of advanced IC products, and at the same time afford the economic risk associated with their use. In most cases, these decision-makers stick to proven technology. This aversion to risk has been a major stumbling block in getting the newest semiconductors into military gear.

Seed money

The VHSIC office's response has been to provide seed money for VHSIC-insertion development programs that, in many cases, run parallel to programs based on non-VHSIC technology. "In most cases where we're working with an ongoing program, they [military-service program managers] have a baseline that they're signed up to [and] that they believe will get them to where they want to go," explains Maynard. "What we offer is an off-line option that we'll work with them. We'll put some of our money in. They put some of their money in."

When the next decision must be made, the program manager has a choice. If the VHSIC effort proves successful, he can opt for the advantages of the latest chip technology: smaller size, additional capabilities, lower cost, or perhaps all three. If it does not pan out, he can fall back on his baseline program.

The VHSIC-insertion push is drawing high praise in at least some contractor communities. "It's a new way of keeping products current, which solves a number of problems," says Richard D. Nelson, who heads up VHSIC-insertion activities at Ford Aerospace & Communications Corp.'s Division in Newport Beach, Calif. At TRW Inc.'s Military Electronics Division, in nearby Redondo Beach, Calif., assistant VHSIC program manager Tom E. Daly is more lavish. He believes the VHSIC-insertion phase "ranks with the most brilliant ideas ever to come along in the organization of technology."

As Maynard puts it, "One of the lessons we're trying to teach the system with VHSIC is that you have to take these generations of integrated circuits, which last only for maybe three or four years, and use them in whatever stage you're in." Other major factors in the fast insertion start include top-down backing for VHSIC from the DOD and the services, as well as strong congressional funding support, Maynard says. He also cites the fairly extensive public relations effort surrounding the program.

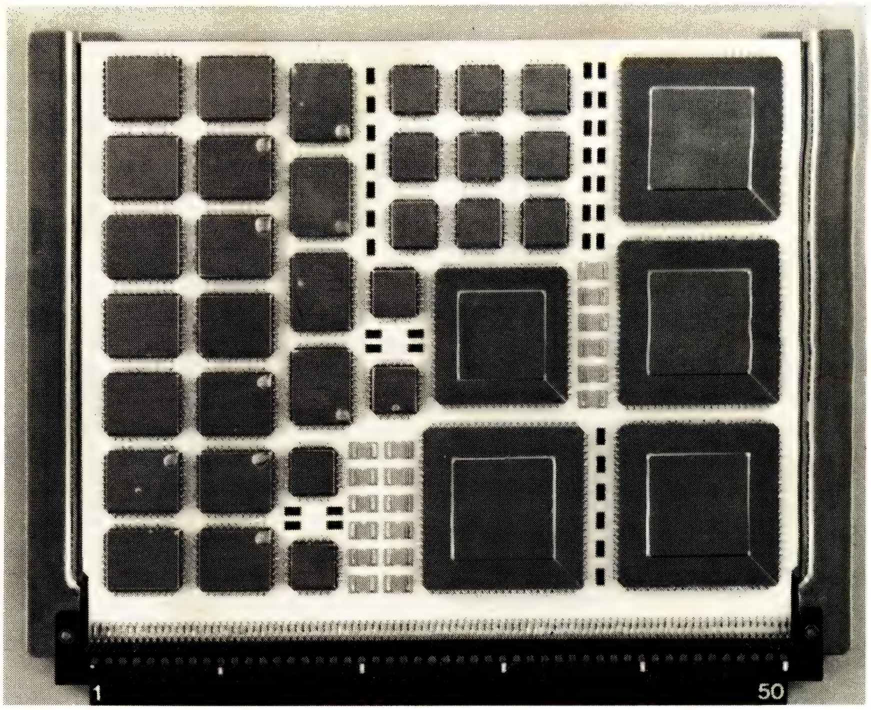
Phase 1 chips could bring an impressive array of benefits to U.S. weaponry; improvements in processing throughput over current military electronics packages could be on the order of 10 times or more. This will greatly promote enhanced capabilities for successive generations of systems, advanced capabilities, new weapons systems not possible without densely packed VHSIC chips, improved reliability and mean time between failures, size and weight cuts, lower power requirements, easier field maintainability, and lower life-cycle costs.

Ten times the power

Some experts, such as Neil F. Hahn, marketing manager for advanced technology at Sperry Corp.'s Defense Products Organization in St. Paul, Minn., believe that advanced weapons capabilities offer the biggest potential payoff for the military. "You look at platforms like cruise missiles and the amount of smarts that they have now. And you figure that, based on the VHSIC technology, you can put something on the order of 10 times their existing computing power in with no real penalty in size and weight. So you ought to be able to do a lot better job of hitting the target."

"The most important role of VHSIC will be its applications in next-generation weapons systems," contends W. J. Huff, manager of VHSIC and advanced processes

2. Pave Pillar. Phase 1 VHSIC chips in ceramic leadless chip carriers mounted to a ceramic motherboard are used on the Texas Instruments SEM-D 1750A data-processor module being developed for the Air Force's Pave Pillar program.



at the Westinghouse Systems Development Division in Baltimore. As an example, he points to the sensor-fusion function of making multiple sensors work together in weapons systems. "The control and management of multiple sensors to achieve synergistic operation is something we couldn't do until VHSIC chips were developed," notes Huff.

Though the advanced weapon capabilities gained from VHSIC represent an enormous potential payoff, other benefits go hand in hand. By shrinking the size of electronics packages in current systems, designers can make room for other things, such as larger warheads and additional electronics for more sophisticated systems.

One example comes from Nelson at Ford Aerospace. The firm recently completed a six-month study contract aimed at designing a VHSIC-technology retrofit for the Joint Service Seeker, a generic target tracker for Army and Air Force missile applications. The goal is to upgrade the tracker from a smart to a "brilliant" weapons system of the fire-and-forget type. To accomplish this task, spectacular reductions in size are necessary, Nelson notes. Using current technology, a 1,000-in^3 box would be required to house the necessary computing power—far too large for any missile-bound electronics package. With VHSIC technology, he says, the system can be reduced to two boards totaling about 15 in.^{2}.

Cost reduction as well

"The synergistic effects of decreased part counts, space, power, weight, and interconnect advantages, coupled with an attendant increase in performance, have an obvious effect on reducing the life-cycle cost impact of fielding weapons systems," says VHSIC director Maynard. The technology's built-in-test and fault-isolation test capabilities make maintenance easier than ever, which will permit appreciable cost savings. In fact, according to Maynard, some preliminary estimates indicate that the cost of the entire $680 million VHSIC program could be amortized by savings from the initial 38 VHSIC-seeded insertion efforts, together with chip-reduction costs due to VHSIC-sponsored yield-enhancement programs.

Military chip contractors are launching a plethora of programs aimed at capitalizing on the VHSIC-insertion opportunity. The six prime Phase 1 VHSIC contractors—Hughes Aircraft, Honeywell, IBM, TI, TRW (teamed with Motorola), and Westinghouse (teamed with National Semiconductor)—have an obvious leg up on the business. They expect to have samples of their own Phase 1 chip sets ready by the end of next year or sooner. Moreover, they expect not only to sell Phase 1 chips and chip sets but also, in many cases, to act as a design and/or fabrication foundry for custom 1¼-μm Phase 1-class chips. Also, they plan to use the Phase 1 chip sets and corresponding custom and semicustom design capabilities as leverage in winning more systems contracts.

Gearing up

According to projections by the VHSIC-program office, the total market for VHSIC chips will rise from about 26,000 this year to about 1¼ million in 1988. Although most Phase 1 contractors say it is too early to estimate the business potential of VHSIC insertion, a majority are gearing up heavily for the technology. Honeywell, for example, is constructing a $50 million plant in Colorado Springs, to be operational in 1986. It will be dedicated exclusively to VHSIC-class technology—1¼-μm minimum geometries or finer—in both CMOS and bipolar processes. The firm expects to sell to military markets and also intends to push into commercial markets with new products based on the technology, says Dallas D. Burns, Honeywell's VHSIC program director.

Contractors not involved in Phase 1 are also running fast to stay in the game. Raytheon Co., for instance, has already invested some $50 million to acquire a VHSIC Phase 1 capability, says Rudy Thun, director of device technology for the firm in Lexington, Mass. Raytheon has completed an insertion study contract to investigate the feasibility of using Phase 1 technology in the Army Patriot Air Defense System and is negotiating for an insertion contract to demonstrate hardware in it.

In addition, Raytheon is bearing the entire expense of a Navy/Industry Cooperative research and development agreement with the Naval Electronic Systems Command in Washington, to develop a floating-point multiplier/accumulator chip incorporating Phase 1 technology for use in underwater acoustic systems. "The No. 1 objective for the Raytheon project is to be looked at in the same

Study sees few commercial spinoffs from VHSIC

Contrary to the expectations of many companies participating in the Very High Speed Integrated Circuits program, speeding the pace of commercial semiconductor efforts and, hence, commercial spinoffs, are apparently not central to the Defense Department project. A study released last month critical of the VHSIC effort asserts that export and national-security restrictions, a structural bias against innovative smaller firms, and a military-systems requirement working at cross purposes with merchants' needs will severely limit the commercial benefits derived from the $680 million program.

"Even if military-system requirements matched commercial-technology goals, the structural and political restrictions currently surrounding an industry-based DOD program would ensure that dual-use developments remain confined to military applications," concludes the report prepared by the Berkeley Roundtable on the International Economy (BRIE). Generally, the 95-page document examines VHSIC within the context of Japanese-U.S. competition in semiconductors and contrasts Japan's "state-centered development strategy" with U.S. commercial development, which is characterized as lacking in government-sponsored programs. Indeed, the report identifies "an inherent divergence between military needs and semiconductor merchant strategies at the level of basic technology development."

The dilemma, as authors Leslie Brueckner and Michael Borrus see it, is balancing the need for strict controls on the leakage of technology to adversaries with the semiconductor industry's economic security, which rests on free exchange of information at home and freedom to compete abroad. Among the current technology controls are the National Disclosure Policy, International Traffic-In-Arms Regulations, and the Export Administration Act of 1979.

BRIE, organized by the University of California at Berkeley to study high-technology industries and industrial policy, identifies lithography, processing technology, manufacturing equipment, and design approaches as potential program spinoffs. But aside from Phase 3 processing technology to be carried out in parallel with Phase 2, Borrus says VHSIC design and production techniques will not be transferable. Borrus acknowledges that VHSIC's technical aims are sound but claims that the commercial sector has already caught up. "Intel is making circuits with 1-micron lines now and will be at a half-micron by the time the military program gets there." The commercial sector is also keeping pace with the military in computer-aided design and engineering, he adds.

BRIE has circulated its report among participants in the VHSIC program but so far has received little reaction. A BRIE representative says the few responses received to date generally agreed with the report's conclusions. Additional industry and government reaction to the study is expected, she adds. The restrictive DOD guidelines imposed on the VHSIC program have serious implications, the BRIE study concludes. Those policies have the long-term effect of "shooting down the most vital national security weapon of all—economic vitality." **–George Leopold**

light as the six designated Phase 1 contractors," declares Bradford Becken, director of technology for the company's Submarine Signal Division in Portsmouth, R.I., which is handling the internal project.

Despite criticism that military restrictions and other factors surrounding the VHSIC program will stifle the technology's potential applications in commercial markets (see "Study sees few commercial spin-offs from VSHIC," above), many people associated with the program agree that the U.S. semiconductor industry has gotten a boost from the VHSIC effort. "I believe VHSIC has been a catalyst for the whole industry," says Sperry's Hahn. "I think it has caused a number of contractors outside of what's known as the Sacred Six [Phase 1 contractors] to accelerate their internal chip capabilities. I think it's certainly had that impact here at Sperry."

At the Office of the Under Secretary of Defense for Research and Engineering, Maynard notes, a concerted effort is being made to fan out the capabilities the Phase 1 contractors have developed to military chip houses and weapons contractors that did not participate directly in the program. Among other things, this effort includes a variety of moves to get information, VHSIC software design tools and procedures, and process details into the hands of those who need them.

The insertion push also includes a series of application workshops sponsored by the VHSIC-program office. These are being held in various parts of the country to acquaint system designers with Phase 1 chips and computer-aided design tools already available. About a dozen workshops have been held to date, with a total attendance of more than 1,500, says Maynard. As many as 10 additional workshops are planned for next year.

To make more chips available sooner and drive down costs, the VHSIC-program office has also launched a $90 million yield-enhancement program involving all the Phase 1 contractors. Goals include increasing yields on Phase 1 fabrication lines from their current 1% to 2% to between 10% and 20%, as well as driving down chip costs from about $5,000 to less than $500 per IC by fiscal year 1986.

ManTech

Another project aimed at making sure that Phase 1 chips will be there when insertion contractors need them is a $100 million VHSIC Manufacturing Technology (ManTech) contract to be awarded soon. That effort will focus on a broad range of generic manufacturing issues, including materials and processes, connections and packaging, and production and testing. "We're trying to go from what to date has been a technology program to address some of the manufacturing issues we feel are necessary to ensure the use and utilization of VHSIC chips in the next two or three years," says Edward J. Morrisey, who heads the Air Force part of the ManTech project at Wright-Patterson Air Force Base, located in Dayton, Ohio.

Maynard notes that enthusiasm about the insertion

3. Electronic warfare. VHSIC Phase 1 technology will be used on the AN/ALQ-131 electronic jamming pod of the Air Force F-16 fighter to increase its reliability and maintainability over the present version. A feature of this program will be a built-in-test capability.

opportunity is high among Phase 1 and non-Phase 1 contractors alike. In fact, about 45% of the 38 projects selected to date will have significant participation by non-VHSIC contractors, he says. Nevertheless, some people, such as Sperry's Hahn, see a need for the VHSIC-program office to put continuing pressure on Phase 1 contractors just to make sure that the technology is adequately dispersed. "You can talk about workshops and the like, but access to the process technologies and design rules they initially had in Phase 1 will be key," Hahn observes. "We've not found all of the Phase 1 people open to giving us their design rules and really letting us act as a foundry. They'd all be glad to design chips for us, but it's not the same."

Others complain about software support. "The lack of design tools to do simulation on the chips is the biggest problem now," says Ford's Nelson. There is no common set of tools available for the various Phase 1 chip sets; rather, each requires its own software system. This puts the responsibility on the user, who must evaluate the tools along with the chips and decide which to buy—as much for software reasons as for chip performance. In addition, there have been complaints of problems encountered in mixing Phase 1 chips from various contractors, since the logic levels required vary from chip set to chip set.

"One of the major stumbling blocks to any program these days is software," Maynard responds. "Creating software is never easy and it's never straightforward." But he notes that efforts are under way to tackle the problem.

On the question of chip interoperability, Maynard notes that the VHSIC office learned its lesson on the Phase 1 chips. As a result, the three Phase 2 contractors—Honeywell, IBM, and TRW—will each be required as their first demonstration task to define and build a bus interface unit (BIU) in the 0.5-μm technology, so that circuits from various contractors will be able to talk to each other. "Fully functional versions of such a chip, which will allow communication among the differing contractors' chip sets, must be shown before contractors get the go-ahead for additional Phase 2 development," Maynard notes.

Design automation

On the design-software issue, Maynard notes that a first step toward alleviating the problem was the development of a VHSIC-hardware-description language that will allow all designers to communicate device information more effectively. Longer-range plans include the use of the Ada-compatible language as a framework for developing an Integrated Design Automation System, with tools covering levels from system partitioning to logic design and mask generation, usable by anyone working

Getting the most out of VHSIC chips

Very high-speed integrated circuits will not only put more processing muscle into defense equipment; they will also require designers to think differently about conventional weapons systems. For that reason, several former executives from Texas Instruments Inc. have formed a new venture to specialize in analyzing, modeling, and simulation of new systems approaches for VHSIC-based equipment. The firm hopes to provide the service to prime contractors and defense agencies as other new technologies also reach the military markets.

Started in September, Merit Technology Inc., Richardson, Texas, is first concentrating on emerging VHSIC chips and the advanced tactical avionics field, says Sam K. Smith, the firm's cofounder and president [see related story, p. 52] and a former vice president of TI, where he spent half his 26-year tenure in the defense field. Merit Technology is marketing a nonpartisan, third-party service for firms and defense agencies interested in getting the most out of the variety of VHSIC chip sets. It plans to provide design definition and simulation know-how to match VHSIC with the partitioning of advanced systems more efficiently.

"Everyone's first impulse will be to brute-force the systems in the same way as when microprocessors first came on the scene," says Merit Technology's vice president of engineering, Ken Pedersen. "Back then, everyone wanted to digitize nearly everything. VHSICs will really open up a whole new ball game, as they erase the traditional throughput constraints by as much as two orders of magnitude. So one reason for this company is that there will be a major discontinuity in the marketplace, and people will need a place to think of new ways to solve old problems. You are talking about a revolutionary step in the next five years, not an evolution."

The new computational avenue will raise nearly as many questions as it answers. "With VHSIC's potential, the question becomes—what is a radar system? Is it just the front end? Where does the signal processing stop, and where does the rest of the system pick up?" asks Pedersen, referring to a change in "black-box" approaches to future airborne systems. Merit plans to apply its design and cost analysis by way of software, knowledge-base systems, and other advanced engineering modeling tools aimed at studying VHSIC potentials.

"If you take an aircraft and compare the airframe costs against the systems costs—like radar—the relative value added by these systems is becoming a much bigger piece of the total pie," notes G. Mel Barney, Merit Technology's vice president of marketing and cofounder. "One thing we see in the military market is that there is a need for a nonhardware-producing company to help optimize the use of new technology—such as VHSIC, artificial intelligence, software, and so on." Merit Technology officials believe the cost of avionics in advanced aircraft will approach 50% compared to just over 30% today. **–J. Robert Lineback**

with the technology. The final phase of the $60 million program aims to develop an intelligent knowledge-base manager that could be wrapped around the design-automation system to simplify VHSIC chip design for unsophisticated users. "We're talking about demonstrating that kind of capability by the end of the program, in the 1988-89 time frame," Maynard says.

Although the VHSIC office decided not to give contracts on bids taken this fall on a portion of the design-atomation system effort, Maynard says the program has now been restructured. Contracts for some parts of it—those that do not require an open bid solicitation—could be awarded as early as next year's first quarter, while others will likely be let in the third quarter.

Included will be enhancement work for the VHSIC-hardware-description language and solicitation for a data-base-management system that would work within the framework created by that language. There will also be an effort to identify and centralize tools needed by non-Phase 1 insertion contractors between now and the time the Integrated Design Automation System is developed. Maynard points out that CAD tools developed under the Phase 1 program—such as tapes for Hughes' Hercules design system—and other contractors' systems are currently available from the Army's Electronic Technology and Devices Laboratory in Fort Monmouth, N.J.

Other efforts aiming to provide contractor software support are also going on parallel to the push for an Integrated Design Automation System, says Maynard. These include plans for a retargetable microcode compiler for VHSIC chips—one that would automatically generate microcode for a particular target VHSIC processor or chip set.

"Say you had a job you wanted to do, and you thought the TRW chip set would do it. They [TRW] have done their work targeting toward the electronic-warfare brassboard area, but you want to use the chip set for something else. You'd have this tool available where you define your function, and it would generate the microcode to translate your function for that chip set." The retargetable-microcode-compiler program is being handled out of Wright-Patterson AFB, and a contract is expected to be let soon, Maynard says.

Mixed chips

Though many insertion programs will require the design of new chips using the Phase 1 1¼-μm technology and the mixing of chips from various suppliers, other projects will be able to use generic Phase 1 chip sets. In fact, Maynard says that about 70% of the 38 projects funded under the VHSIC program offer some chips developed under Phase 1, while about 20% are using VHSIC Phase 1 brassboards. Some insertion projects are specific to particular weapons systems, though many others stress an approach involving standard modules that can be used as building blocks in designing systems for a number of weapon platforms.

TRW is heavily emphasizing the latter approach. The firm's 13-chip set includes eight chips fabricated in a triple-diffused TRW bipolar process and five CMOS chips, two designed by Phase 1 partner Motorola, which will act as a foundry. Daly, TRW's assistant VHSIC-

4. Fire control. Texas Instruments' VHSIC insertion is being applied to the Army's M-1 tank's fire-control processor. The new system will be smaller, more reliable, and contain more functions than the original. TI is developing a brassboard fire-control system.

program manager, notes that the chip set "creates not only a technology but an architecture that establishes a set of components intended to be useful to many other companies."

The TRW approach partitions systems into preprocessing, signal-processing, and data-processing functions (Fig. 5). The firm is developing a set of preprocessing modules unique to each weapons application. They can be supplemented with programmable signal-processor modules used for multiple applications. Data-processing modules can be used for control or to provide additional processing.

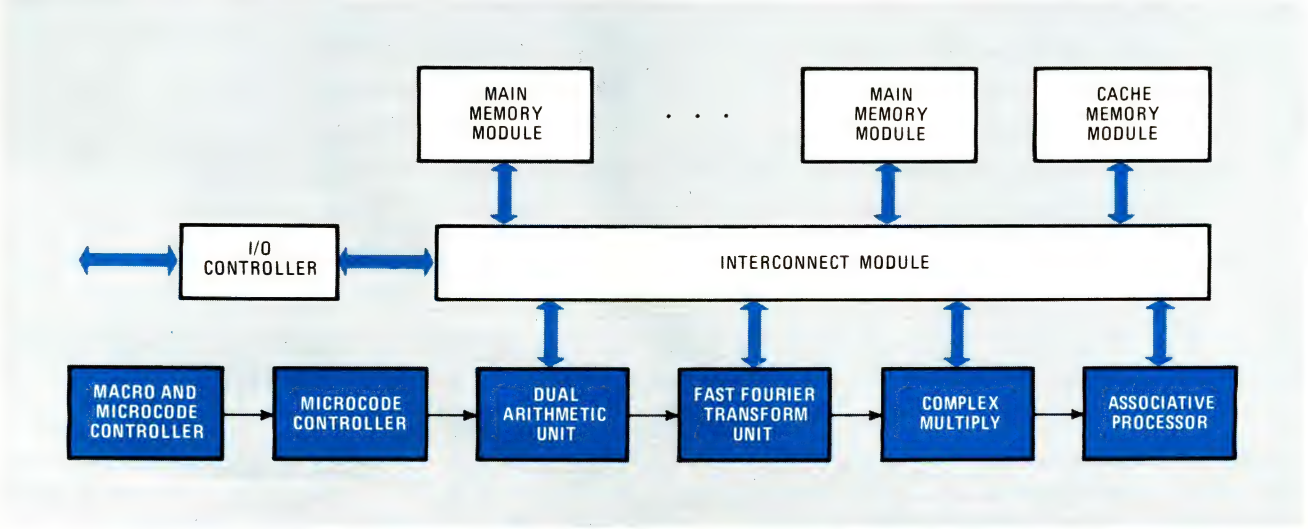
Modules are ideal building blocks for developing digital systems, TRW officials say, since maintenance is performed and redundancy switching techniques are applied at that level. The use of modules produces standardized interfaces, and the distribution of microcode within the module simplifies them.

The initial VHSIC-seeded insertion projects—15 of which were funded in fiscal 1983—will mainly promote advantages other than weapon performance improvement. Some of the 23 efforts awarded in fiscal year 1984 will focus on beefing up weapon capabilities, says Cmdr. Carl Monk, a VHSIC-program deputy director.

According to sources in Honeywell's VHSIC office, four classes of insertion contracts have been awarded to date. The first is aimed at retrofitting systems currently in production and will yield such benefits as space and weight savings as well as lower power requirements, without improving system performance. The second will provide the same kinds of benefits for current production systems while also improving performance. The third class comprises programs that take into account the eventual need for VHSIC chips as part of a preplanned product improvement in weapons systems now under development. Finally, there are contracts that involve concept development for new weapons capabilities that could only be accomplished with VHSIC technology. In addition, the Phase 1 development effort called for brassboard demonstrations targeted at specific weapons systems.

VHSIC insertion

According to Maynard, about one third of the projects funded by the VHSIC office so far are tailored to insert VHSIC technology into operational weapons systems at the earliest possible date. Most of those are scheduled to go into the active inventory between fiscal 1986 and fiscal 1988. In nearly two thirds of the programs, there will be cost reductions based on system life-cycle costs and the projected price of the chips. Furthermore,



5. Modular processing. Using its 13 Phase 1 VHSIC chips, TRW has developed a set of standard processing modules that can be used as building blocks for specialized applications. Shown is a signal processor built up from some of the modules.

6. Cutting the cord. The TOW-2 wire-guided missile is one of the Army's main antitank weapons. VHSIC Phase 1 technology is being applied to eliminate the wired guidance and to add an autotrack capability. TI has already produced an autotrack brassboard.

VHSIC technology will facilitate performance improvements in about 85% of the programs.

The first existing system to benefit from VHSIC Phase 1 technology will be the AN/ALQ-131 electronic-warfare jamming pod used on the Air Force F-16 fighter plane. In its current version, the pod has exhibited less than desired performance because of reliability and maintenance problems. But an insertion effort awarded to TRW in 1983 for upgrading the pod will develop a modular, VHSIC-based approach that is expected to diminish these problems greatly. By using the advanced built-in-test capability that VHSIC chips make possible, field personnel should be able to isolate problems quickly and replace malfunctioning modules on the spot. This is expected to reduce life-cycle maintenance costs significantly. TRW plans to deliver modules for the system this month, with flight testing scheduled next year.

Other insertion programs—such as the Air Force Pave Sprinter project, which calls for the development of a family of replaceable modular subsystems for a variety of avionics packages—will take a similar approach. The intelligent use of the built-in-test capability on the chips is a critical design consideration, Maynard believes.

Most Phase 1 chips devote about 10% to 12% of their real estate to the function, he notes, and the use of the capability must be well thought out. "If somebody expects that some kid in a maintenance shop is going to take a 148-pin chip carrier off with a 450-W soldering iron, then they've got a problem. What we've got to do is access the level of competence we expect to see in the field and then build systems to mate with that."

Another example of the modular approach to VHSIC insertion is a project for upgrading the programmable signal processor for APG-65 radar systems. In the 1990s, Navy and Air Force fighter planes will require the faster radar signal processing that VHSIC chips will make possible. Under contract from the Navy, Hughes Aircraft Co. is undertaking a task that calls for delivery of VHSIC-based demonstration hardware in March 1987. The company aims to put 10 times the processing power of current-generation Hughes APG-65 radar systems in a package one fifth their size.

Fairchild Camera and Instrument Corp., Mountain View, Calif., is a subcontractor and will serve as a foundry to process the VHSIC Phase 1 advanced cascode emitter-coupled-logic chips that Hughes is designing for the project, using a macrocell approach. Including a study contract awarded in fiscal 1982, the effort is funded at about $12.8 million, says Francis J. Lueking, acting program manager at the Naval Air Systems Command, Washington.

A major emphasis in the program is on the design of a modular system that can be used in a variety of fighter planes, such as the Navy F/A-18, the F-14, and the Air Force F-15, Lueking indicates. Besides greater processing power, the system is expected to provide a greater capability for more sensitive target detection. Furthermore, significant improvements—on the order of 5 to 10 times—are expected in system reliability, thanks to such factors as the smaller number of connections needed with dense VHSIC chips.

Because of on-chip built-in-test circuitry, system maintainability will also be improved, Lueking says. Depending on funding approval for a contemplated military effort in preplanned-product improvement, a VHSIC-based system could be in the field by 1990.

TOWed missiles

A more application-specific insertion program is the Army's effort to upgrade its TOW-2 missile-guidance system. Phase 1 technology could make life in the battlefield significantly easier for Army missile gunners.

The TOW-2 is the Army's workhorse antiarmor weapon (Fig. 6), fired from a variety of weapons platforms, including tanks, helicopters, jeeps, and ground-mounted tripods. The tube-launched, optically tracked missile is currently guided by digital signals sent down a pair of

7. Mark 50. The Mark 50 is to be the Navy's next-generation torpedo. Honeywell is the prime contractor for applying VHSIC Phase 1 technology to this weapon system. The program's design goal is to reduce the volume and weight of the present electronics package.

wires that trail out behind it as it speeds toward its target. One factor limiting flexibility in the current TOW-2 system, however, is the need for the gunner to maintain his crosshairs on the target until missile impact. In addition, the missile's use is restricted over water and over high-power lines, since either can disrupt signals on the trailing wires. Further, the wires limit the missile's speed.

The Army hopes to eliminate all these problems by using high-powered VHSIC chips to do away with the wires and automate the system's tracking capabilities. In September, Hughes was awarded the first of two expected demonstration contracts on the TOW-2 program. Funded at just under $2 million, the 15-month effort should be flight-tested in the second half of 1985 on a VHSIC-based wireless radio-link guidance system, says James Patterson, an engineer in the Army Missile Command's TOW project office at Redstone Arsenal, Ala. The project will employ a Hughes Phase 1 chip known as the STS (signal tracking subsystem) chip. Hughes will provide both the receiver for the missile and the transmitter for the launch system. This will allow the missile to fly faster and farther as well as over water and power lines, Patterson says.

The next step will come in a yet-to-be awarded demonstration contract to develop an automatic tracking capability. As envisioned, as long as the missile operator keeps the target in the system's field of view, he will no longer have to maintain crosshairs on it. This would increase the odds of a hit by eliminating gunner jitter and vehicle-induced vibrations. It would also let the operator find and fire on another target within the field of view before the first missile hits.

Both Hughes and TI have expressed interest in this project. Under a $530,000 U.S. Army contract, TI has already produced an Autotrack brassboard. While working on the demonstration vehicle, the Dallas firm has TOW-2 hardware in field tests, using current chip technology. Under the insertion contract that should be awarded next year, the objective will be to replace that hardware with VHSIC-based modules, says Wilson at TI's Equipment Group. The TOW-2 insertion effort is an experimental program to date and has not been scheduled for implementation in the field.

Another weapon-specific insertion effort involves the Navy's Mark 50 Advanced Lightweight Torpedo program (Fig. 7). The insertion of Phase 1 technology will not produce advanced sonar-guidance and control capabilities. The reason is that the electronic system in the VHSIC-based version of the next-generation weapon will be functionally equivalent to the one found in this torpedo's standard design version, says H. Timothy Singleton, torpedo systems engineer in the Mark 50 program office at the Naval Sea Systems Command, Arlington, Va. What VHSIC will do is make room for something else in the system—something that is currently classified, Singleton says. The design goal is to shave 6 in. and 40 lb off the 24-in.-long, 122-lb electronics package in the non-VHSIC-designed versions.

As the next-generation lightweight torpedo for use by Navy destroyers and aircraft, the Mark 50 is being designed to replace the Mark 46 lightweight torpedo and has been under full-scale development by the Navy for about four years. The VHSIC part of the program, in effect an add-on to the main one, is being funded by the VHSIC office.

As the Mark 50's prime contractor, Honeywell has been awarded the insertion work and has $3 million in hand—the first increment in what is planned as a multiyear undertaking, says Dallas D. Burns, Honeywell's VHSIC program director. The MK-50 VHSIC package will likely use a mix of bipolar and MOS chips, says Singleton. In certain areas, such as those that require signal processing, speed will be critical; in other areas, heat dissipation will be more important. In fact, according to Singleton, "one of the more challenging parts of this effort will be trying to manage the heat. Right now, that does appear to be one of the biggest problems."

VHSIC Phase 1 packaging

Along with its injection of 1¼-μm high-performance devices, Phase 1 of the Defense Department's Very High Speed Integrated Circuits program is introducing new and advanced packaging into military-electronics manufacturing. Many of the all-ceramic packages of Phase 1, unlike commercially available carriers, have their input/output pads on tighter or staggered centers, as in Texas Instruments' open-via type, and a few get away from wire-bonding chips to their eventual packages, as in the Honeywell VHSIC package, which uses tape-automated bonding.

In Phase 1, each of the six VHSIC-program participants took differing approaches. Honeywell Inc., Minneapolis, used TAB on its otherwise standard pin-grid array with 180 pins on 100-mil centers. Hughes Aircraft Co., Newport Beach, Calif., on the other hand, went to a 148-lead flatpack on 25-mil centers. IBM Corp.'s Federal Systems Division, in Manassas, Va., also based its 240-pin, 100-mil-centered VHSIC package on PGA, but used its own Decal process [*ElectronicsWeek*, Nov. 19, 1984, p. 19] for bonding its solder-bumped chips to the package's chip cavity.

For its largest Phase 1 chips, Texas Instruments Inc., Dallas, is going to a multilayered open-via ceramic leadless chip carrier with two tiers of bonding pads: standard I/O pads on its periphery on 50-mil centers and an inner row of staggered vias on 50-mil centers. In effect, this doubles the density of a standard 50-mil chip carrier.

TRW Inc., Redondo Beach, Calif., and Westinghouse Electric Corp.'s Defense and Electronic Center, Baltimore, are going with leaded chip carriers for their large VHSIC Phase 1 chips of 132 and 224 leads, respectively. The TRW package has its leads on 25-mil centers; Westinghouse has gone to 20 mils—the tightest spacing yet.

For the next generation of VHSIC chips, the DOD is developing two families—PGAs with pins on 50-mil centers and leaded and leadless chip carriers with I/O pads on 20-mil centers.

—Jerry Lyman

At Honeywell, associate VHSIC-program director Jay Patel says the firm is looking at a number of options for circuit types. These include the development of custom analog-to-digital converters that would use a Honeywell linear process for the front end, together with VHSIC-class technology to handle sample-and-hold and conversion functions. Other options include the use of custom 1¼-μm chips or modified versions of Honeywell's Phase 1 chips, as well as a variety of VHSIC-class gate arrays and a version of the Navy's standard AN/AYK-14 computer built with VHSIC technology.

The Mark 50 effort will not necessarily convert all of the electronics in the non-VHSIC design to VHSIC technology, however. "We are still in the process of identifying areas of the torpedo that should be considered," Singleton points out, with an eye to the space and weight savings. "It may be that we won't need as much as we think, and we won't convert everything to VHSIC if we don't have to."

Because of the need to prevent Soviet access to VHSIC technology, the DOD has placed restrictions on discussion of certain details of insertion programs. The following items are unclassified descriptions chosen for their variety and interest:

- Integrated Terrain Access and Retrieval System. Fighter pilots of the future may have quicker access to terrain data with a system developed under this $4.5 million contract, awarded six months ago to TI. The brassboard effort calls for VHSIC chips to be applied to the processing of stored terrain information, carried in airborne solid-state memory, for digital maps that can be called up on a cockpit cathode-ray tube. For this system, involving a 2½-year program, TI is developing three versions of the electronics—two using conventional technology and one using VHSIC chips. In June 1985, a decision will have be made as to whether or not a VHSIC-based version will be used on systems in the field.
- AN/UYS-1 sonar signal conditioner. IBM Corp.'s Federal Systems Division, Manassas, Va., was the only Phase 1 contractor to deliver its brassboard on time when it demonstrated this system in a P-3 aircraft last May. But the brassboard effort's fate depends on the Navy. The service is debating whether it should retrofit with VHSIC hardware its standard programmable signal processors used for antisubmarine warfare in a variety of aircraft. At issue is whether to go for the upgrades now or to save the money until the next-generation standard signal processor, known as the enhanced modular signal processor, rolls off the production line in the mid-1990s.

"The Navy's dilemma is that advances for the processor are going on in parallel with the VHSIC Phase 1 brassboard insertions," explains Bob Estrada, IBM's VHSIC-program manager. "While the Navy wants improved performance today, it knows an investment in upgrades will be obsolete just a few years after the upgrades are complete." Meanwhile, Westinghouse, TRW, and others have responded to a request for proposals put out by AT&T to provide the VHSIC components for the processor.

- APG-68 radar for F-16 fighter. Although this contract, which comes under the DOD's budget for fiscal 1985, has not yet been awarded, design work is expected to be under way early next year. Insertions begin in 1985, says W. J. Huff, manager for VHSIC and advanced processors at Westinghouse Electric Corp.'s Systems Development Division in Baltimore. The firm is bidding for the contract.

The effort will involve retrofitting Phase 1 technology into a box of the same size used in current-generation F-16 radar systems; it "could save the Air Force hundreds of millions of dollars because of the vastly improved reliability and capability," Huff asserts. Compared with the current system, the VHSIC-based increase in functional capability, as measured by instructions per second, will be tenfold. Power requirements will be lowered by a factor of seven, and mean time between failures is expected to show a fourfold improvement, Huff notes. □

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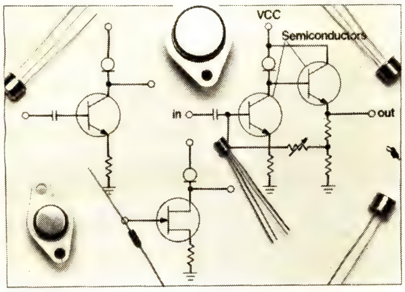

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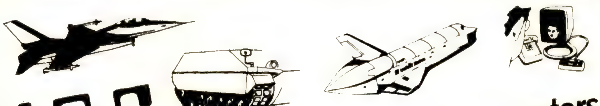

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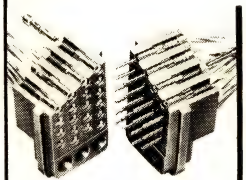

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Exports now account for more than 50% of the $1.3 billion annual sales in electronics versus 28% of turnover for industry as a whole, representing the highest rate of growth in the economy. According to a report done by Dun & Bradstreet, four of the ten leading companies in sales growth for 1983 were in electronics and averaged a phenomenal 300% increase over 1982. The 60% added value of electronics' products in comparison to 45% for all other goods produced further emphasizes the economic importance of electronics.

Despite a turbulent political environment, successive Israeli governments have implemented long-range programs to stimulate the growth of science-rich industries. Of primary importance is the Office of the Chief Scientist (OCS), established in 1968 to allocate funds for R&D. Up to half the development costs for new products can be granted to firms that receive OCS approval, which is largely based on the product's commercial viability and export potential. In 1983 about 60% of OCS's $50 million budget was spent on some 200 projects in the electronics branch.

Programs for Growth

Another important agency, the Binational Industrial Research and Development Foundation (BIRDF), was founded in 1977 by Israel and the US to "promote and support joint nondefense industrial research and development activities of mutual benefit." Each country contributed half of the initial $60 million trust fund. Under BIRDF any pair of companies, one American and one Israeli, may submit a proposal for joint development of nondefense products with high commercial potential. BIRDF can grant up to $400,000 on the condition that the funds are repaid if the project succeeds. To date, 76 joint ventures have been approved and about $21 million has been granted, much of it for development of new electronics products.

Investment in Israeli industry, particularly in electronics, is being encouraged by the government through agencies such as the Israel Investment Authority and the Israel Export Institute. Incentives offered to foreign investors include R&D cost sharing, tax benefits, cash grants and soft loans, free repatriation of capital and profits, and no restrictions on ownership. Free trade agreements with the European Economic Community (and soon with the US) and similar arrangements with nine other industrialized nations allow duty-free access of Israeli products to the world's most active markets.

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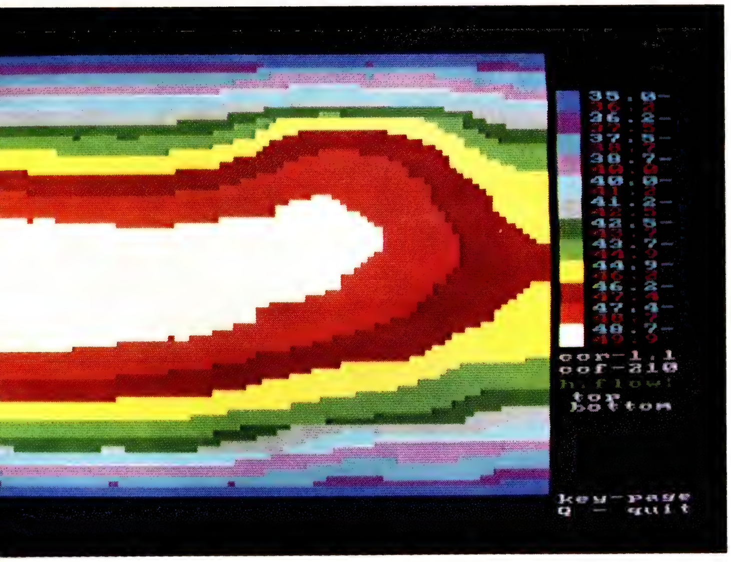
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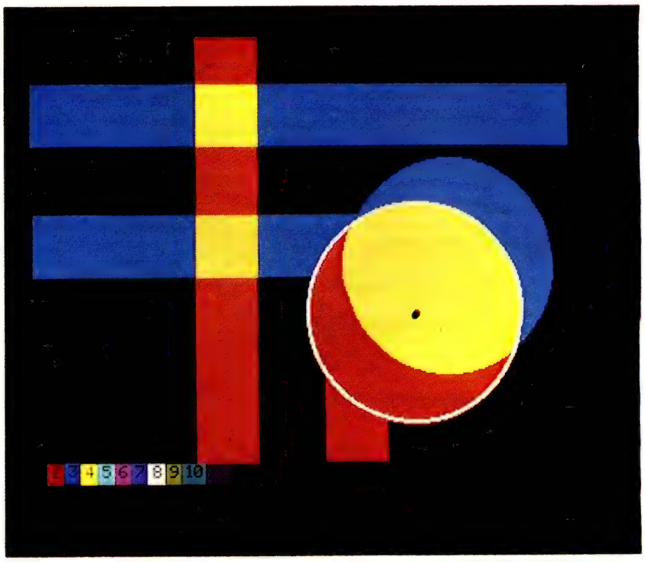
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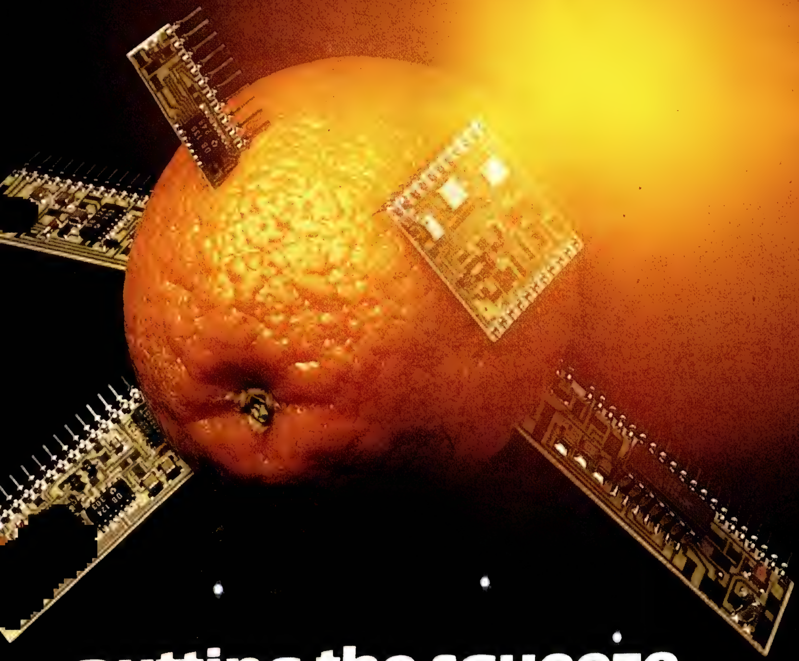

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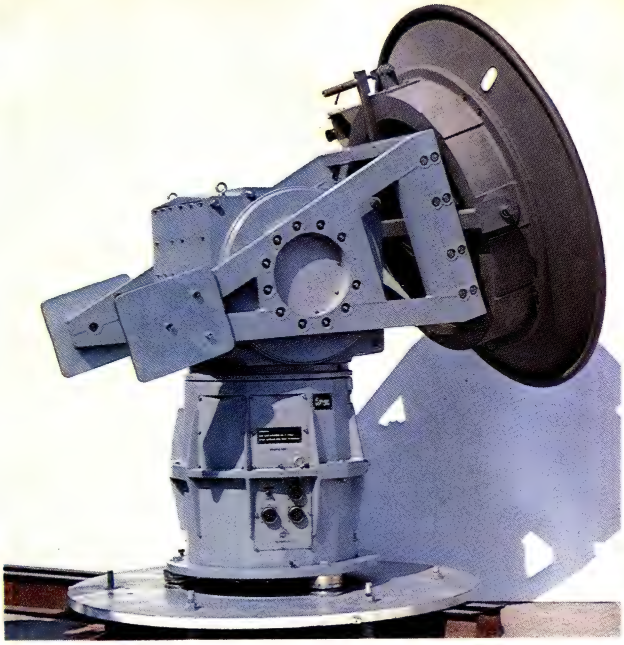
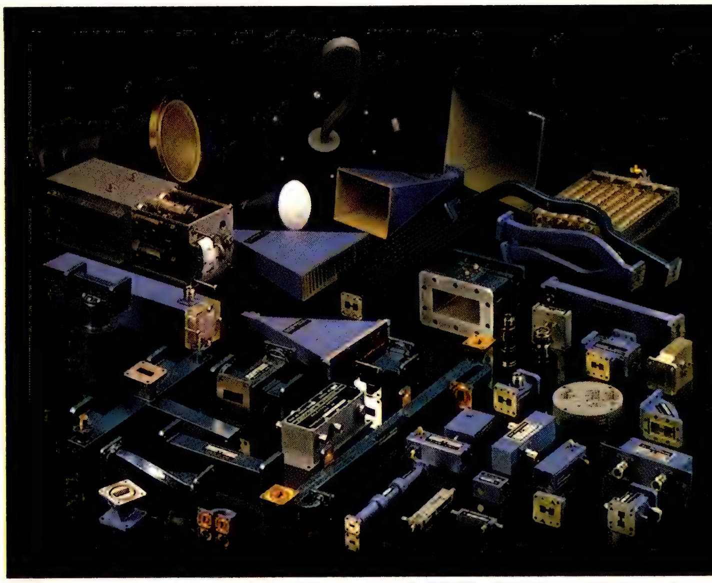


This antenna positioning system developed by Orbit will be used in equipment to measure North Sea iceberg reflections.



ECI Telecom's Microguide division develops microwave components for use in electronic warfare systems.

Many companies in the US, attracted by the receptive business climate, zealous commitment to R&D (2.4% of gross national product), and a stable community of skilled (and less expensive) manpower, have established subsidiaries in Israel. Intel Corp. opened a semiconductor design center in Haifa in 1974, followed by National Semiconductor Corp.'s Herzlia center in 1978, and Motorola Inc.'s in 1983. Much of the design work for the new 16- and 32-bit microprocessors now on the market was performed in Israel. Pleased with the success of their Israeli design investments, Intel decided in 1980 to build a wafer fabrication plant in Jerusalem, while National Semiconductor recently finalized plans for a $50 million manufacturing facility in Migdal HaEmek. Digital Equipment Corp., GTE, Veeco, Vishay Intertechnology Inc.—these are just a few more of the American electronics companies operating in Israel.

With her limited natural resources and a relatively small workforce, Israel cannot compete with the mass production conglomerates in the US, Europe and Japan. The key to Israeli marketing strategy is identification of product lines for which there is limited demand. Advanced systems that may not be worthwhile for the giant companies can be profitably manufactured in more limited series. Less developed countries have a need for equipment with a lower degree of sophistication, customized for their particular requirements. In tapping limited-demand markets, Israeli firms have developed some of the most innovative and technologically advanced equipment in the world.

Dr. Electronics

A case in point is the strong position of Israel's medical electronics systems. Research and development in medical electronics enjoys strong support in Israel, where there is one doctor for every 425 people. Israeli doctors, nurses, and technicians are considered among the world's best. The emphasis on medicine is nothing new to the Israeli people.

In the era of high technology, cooperation between physician and engineer has yielded devices that are revolutionizing medical practice. A prime example is Elscint, a Haifa-based company that has captured 12% of the computerized tomography market and 8% of the nuclear medical imager business in the US against such competition as General Electric and Siemens.

The incredibly small Sharplan Nd:YAG Ophthalmic Laser System produced by Laser Industries created a stir when introduced in November 1983. The machine is used to resolve problems associated with cataract surgery. The new system, smaller, lighter, less expensive, and with several innovative features, is clearly superior to complex expensive devices currently in use. Other advanced products in medical electronics by Israeli companies are a programmable pacemaker, an implantable pancreas, and a portable artificial kidney machine.

Telrad sets the pace in telecommunications, producing electronic digital main and private telephone exchanges; mobile exchanges with from 80 to 10,000 lines; the Key bx computerizd office telephone system; all of Israel's authorized telephones; voice and data communication terminals; and military communications equipment.

More than 50% of Telrad's 2,000 employees are engineers and technicians. The firm invests heavily in the R&D of microprocessor-controlled devices such as the INFO 4000 (an executive voice/data touchscreen terminal) and the latest Key bx system, Digital 256, (an advanced PBX for the modern business office). Telrad exported 30% of its 1984 $100 million in sales, mostly to the US.

The company's hottest product is the Key bx, a smart telephone system that can handle up to 28 outside lines and 64 internal stations, eliminating the need for professional operators. Telrad expects to exceed $50 million in Key bx exports this year.

A wholly owned subsidiary of Koor Electronics Ltd., Telrad is the largest manufacturer of telecommunications equipment in the Middle East. Koor Electronics is a division of Koor Industries Ltd., a conglomerate of 250

“How can we make decent boards from such terrible artwork?”

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INSIGHT is a computer system designed for PCB manufacturers. It inspects and corrects CAD or hand-taped artwork; generates NC and test data; adds tooling graphics; and steps and repeats parts for output on Scitex's laser scanner / plotter.

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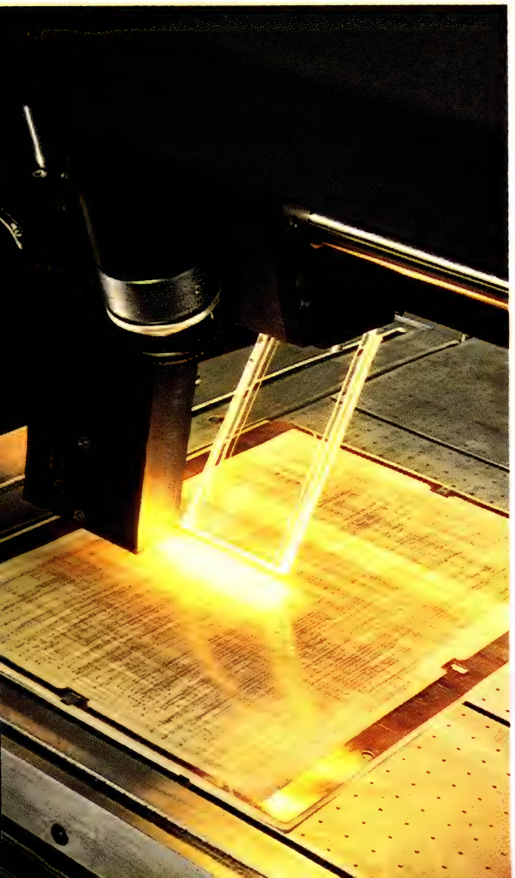
industrial firms that has annual sales of more than $3 billion—about 13% of Israel's entire industrial output. Other subsidiaries are: Telkoor, specializing in microprocessor control, microwave communications, and telemetry technologies; Keren, producing radio frequency systems used in electronic warfare equipment and civilian long-distance radio and telephone links; and Koor Communications & Security, which customizes communication, computer and security systems for business and government agencies.

An affiliate jointly owned with Elbit, Eltek is the nation's leading producer of printed-circuit boards, supplying most of the electronics firms in Israel as well as exporting to the US and Europe.

Newest addition to the Koor subsidiary family is Softel, specializing in computer-aided design for very large-scale integrated cirucits and VLSI chip design. Softel was started in 1983 with an initial funding of $8.3 million for a three year growth program. The company operates a sophisticated chip design center for customized ICs, mostly for the US market. Scheduled to enter the market in first quarter 1986, Softel's turnkey computer-aided design system for VLSI supports all phases of the IC design cycle, facilitating modern hierarchical design methodology. The company projects $25 million sales within three years.



Pinpointing market needs and proper product definition are principles that apply in every field of Israel's professional electronics: components, computers, consumer products, defense, and telecommunications. As Israel's electronics giant, Tadiran does it all: total sales for 1984 will top $600 million, with about $270 million of it coming from exports.

Defense, Too

Tadiran devoted 25% of its engineering staff and $58.4 million to R&D in 1984, continuing its policy of new product development. Explains managing director Yigal Ne'eman, "We have made several breakthroughs using technology in innovative ways, confirming our belief that the future of the company will increasingly be dependent on the success of our endeavors in R&D. Accordingly, our investment both in manpower and equipment for R&D is given priority."

This stress on in-house development has borne fruit in all five manufacturing divisions. Components now include thick and thin film hybrid circuits, hybrid modules with surface-mounted devices, LSI circuits using switched capacitor and gate array technologies, and infrared detectors.

Tadiran, which started in 1961 as a maker of batteries, today produces a broad range of lithium and nickel-cadmium batteries used in science, industry, and medicine for special power requirements. New military communications equipment includes fiber-optic and millimeterwave terminals, digital communications encryption devices, and graphic communications terminals. In the area of telecommunications, a new generation of digital voice/data hybrid PBX systems for office automation will enter the market soon.

Military communications is the largest business area, with about 33% of total sales, and military systems account for another 23%. Although a even split between civil and military sales is the desired goal, marketing realities indicate otherwise: The small home market and inability to compete with Taiwan and Japan in labor costs dictate against mass production of consumer products. About 80% of export sales are military and this segment continues to grow faster than the civilian market.

In defense electronics, Tadiran is rapidly becoming a leading systems house, offering custom-designed turnkey computerized command and control systems in addition to its vast array of very-high, ultra-high, and high-frequency secure communication and frequency-hopping radio systems.

By contrast, Electronics Corporation of Israel (ECI) has seen a steady shift in percentage of sales toward the civil end of its product line. In 1983, for example, only 25% of sales came from the military market, as compared to 82% in 1980. ECI's telephone circuit multipliers (TCM) are the main cause of the turnabout. Used between central exchanges, the TCM doubles voice communications on existing links using time assignment speech interpolation (TASI) combined with ECI's own digital processing technology.

The TCM is an economical alternative to new communications infrastructure. In December 1983 the West German Deutschesbundespost contracted for 172 TCM systems and spares for $20.4 million. Meanwhile, ECI has introduced to the US market its new DTX-TI, a physically smaller, less expensive switching and transmission system designed for use with digital links.

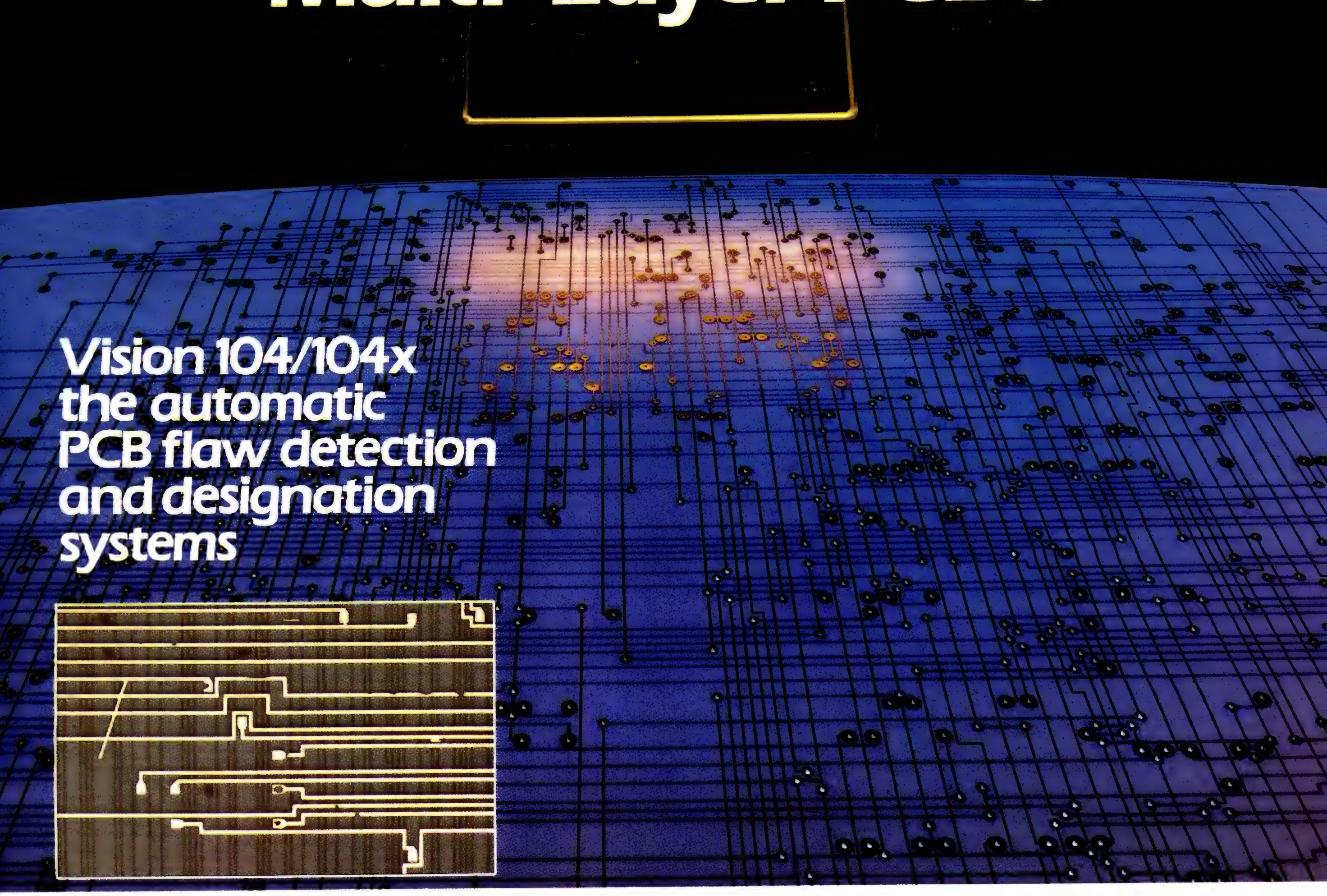
Defense systems from ECI include air, naval, and ground forces Communications Control Systems of the MCCS-500 family and fixed and mobile air traffic control systems. Recently the company announced it sold $6.5 million worth of turnkey radar, communications, meteorological, and navigation equipment to five airports. ECI's Microguide Division designs and produces wavequides and other microwave components for radar and electronic warfare applications.

Graphically Successful

One of the most interesting success stories in Israel's nondefense electronics industry is that of Scitex, a company that has developed sophisticated applications of digital image processing for printing, publishing, CAD, and mapping. Last year Scitex had total sales of $71

Optrotech's Vision line of automatic electro-optical inspection and gauging systems detects and marks printed-circuit-board pattern defects like cuts, shorts, and pinholes.

It Takes Vision to Produce the Most Advanced Multi-Layer PCB's



Vision 104/104X are electro-optical inspection and gauging systems designed to test PCB artwork and internal layers before lamination.

Vision 104 detects pattern defects such as cuts, shorts, nicks, pinholes and improper conductor/clearance width. Vision 104X incorporates all the characteristics of the Vision 104, plus the ability to inspect an inner-layer with plated through holes; and will detect all the breakouts of holes in the buried VIAs' inner-layers.

Vision 104/104X are non-comparison systems that do not require any reference data, but have an independent feature extraction logic, therefore, they have the capability of working with extremely fine conductors found in the most advanced multi-layer PCB's; precise alignment of the PCB's on the moving table is unnecessary, and the systems are insensitive to the dimensional stability of artwork and laminate.

Vision 104/104X automatically mark flaws, generate flaw coordinate printout and provide the operator with an option to call up a magnified TV picture of the defects.

Vision 104/104X will increase your production yield particularly in the production of multi-layer PCB's, will cut labor costs and will provide you with on-line process control.

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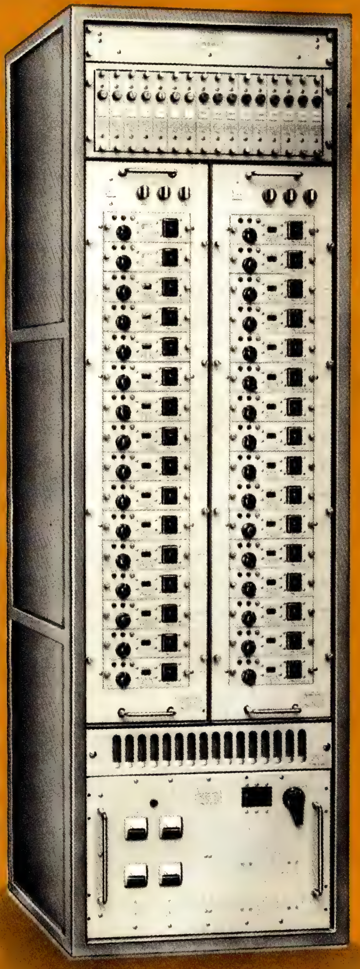

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million, a whopping 41% increase over 1982. Heavy investment in R&D (15% of sales) has paid off. Over 200 systems are in operation throughout the world. *Time, US News & World Report,* and *Newsweek* all use Scitex interactive computer graphics systems. Japan, where high quality printing is taken for granted, accounted for 16% of turnover in 1983.

Just introduced, the SATLIGHT transportable scanner will permit photographers in the field to transmit color shots of breaking news events within seconds to their home offices via satellite or high-speed landlines. The digitized scanner data is processed in a Scitex Response pre-press graphics system for electronic editing and insertion into the waiting page. During the 1984 Olympics some 200 photographs were made available to news media around the world using this equipment; a SATLIGHT was also used for coverage of the Democratic and Republican national conventions.

Scitex' new INSIGHT PC/CAM system is dedicated to pc board production. The system accepts artwork from tape or film and converts data from vector to raster form. Checking and correction of artwork design rules, layer alignment, and drill digitization are performed on screen.

A 42-by-75-inch scanner format allows performance of step-and-repeat operations and plotting of multiple panels at once. The digital data is then output on punched tape for numerical control production. By rapid and precise processing of design into production-ready tooling, INSIGHT cuts lead times and increases pc board produciton yield. Scitex has already received orders from the giants in the industry, including Teradyne, Hewlett-Packard, Litton in the US, and Matsushita in Japan.

Young Upstarts

Advances in computer science have accelerated the pace of the new industrial revolution in Israel as in all the developed nations. Companies like Tadiran, ECI, and Scitex have been joined by scores of newcomers in all branches of electronics.

RAD Computers specializes in innovative devices for data communications: short-haul modems, remote line monitors, multiplexers, converters, data compressors. The company is offering a new four-wire synchronous modem that permits half- or full-duplex operation to a range of 10.5 miles over unconditioned lines at rates up to 19,200 bits/s.

Another new product, the CompressoRAD, doubles line capacity and allows transmission at 4,000 b/s and 9,600 b/s over dial-up lines, eliminating the need for leasing or adding on lines. The CompressoRAD uses an adaptive universal algorithm (Hoffman) developed at the Technion for compression of any kind of data: text, numerics or graphics. New models of the CompressoRAD will provide transmission rates up to 19,200 b/s.

Since start-up in 1981, RAD's export sales have increased 100% and a 200% growth in sales is anticipated over the next two years. RAD puts 40% of revenues into R&D. Says general manager Zohar Zisapel, "the high speed data communications market will be booming in the near future—RAD is going to be there."

By narrowing the scope of its development efforts, Orbit Advanced Technologies has also found a place in the sun. Orbit designs and produces customized antenna positioning systems for testing rf antennas, radar, and data link tracking systems. A private company owned by three partners, Orbit had sales of $2.6 million in 1983 and projects $3.2 million in sales for 1984.

Again, the policy of choosing products that, because of their customized nature, are not worthwhile for large producers pays off: Orbit is number 2 in the world for supply of antenna positioners. The systems provide controlled positioning from microprocessor-based control units via power control units. Control options for from one to six axes are offered and analog or digital position displays are available.

Finding Flaws

Another recent and flourishing start-up (1981), Optrotech has achieved a technological breakthrough in the neglected field of pc board inspection. The firm's Vision 104 Automatic Optical Inspection (AOI) machine is selling briskly to large pc board manufacturers in the US, Europe, and Japan, and a huge backlog of orders is building up. Vision 104 combines artificial intelligence technology with optics to inspect pc board artwork and the boards themselves for flaws—cuts,

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shorts, pinholes, copper splashes, and design rule violations—with 98% effectiveness.

Human visual inspection has become less and less efficient as the multi-layer complexity of today's high circuit density pc boards increases. Resulting high rejection rates mean lower production yields. No wonder then that the vision system was an instant hit when it entered the market in March 1983. Already 50 systems have been shipped to Data General, Hewlett-Packard, ICL, Northern Telecom, Texas Instruments, Hadco, and others. Projected sales total for 1984 is $10 million and the backlog extends through first quarter of 1985. By mid-1985, Optrotech will introduce the improved Vision 104X with features that enable it to find flaws in drilled panels, and an even more advanced Vision 105 is in the works.

High-tech Holding

In August Optrotech went public and is now traded on the Over The Counter market in New York. Forty percent of the stock is owned by Elron Electronics Industries, an Israeli holding company that was instrumental in founding Elbit Computers, Elscint, Optrotech, Fibronics and other high-tech companies in Israel and the United States.

The first and largest of Elron's prodigies is Elbit Computers, established in 1966 in partnership with the Ministry of Defense (MoD). In a 1970 agreement with Elron, Control Data Corp. bought out MoD's holdings and, since September 1983, Elbit's ordinary stock has been trading Over The Counter. Through its associations with MoD and Control Data, Elbit was able to develop and market a broad range of computer-based military and commercial systems. Elbit's success story is evidenced by the bottom line facts: revenues increased by 275% in the past five years to $118.6 million in the 1984 fiscal year (46% in exports).

Diversification in the civilian and defense markets and the development of new high-tech products continue to characterize Elbit's philosophy. Although two-thirds of the company's output is military, mostly for the Israel Defence Forces (IDF), continued emphasis is placed on the civilian market. Experience in computer development for the IDF, where application of state-of-the-art technology is a must, has enabled Elbit to develop a line of new, advanced commercial equipment. The ANAT family of IBM compatible computers, emulating IBM 370/125, 370/158, and 4331-2 computers, are compact and cost effective. A remote clustered terminal system, RAN, accommodates up to 15 IBM-type 3270 terminals on a single IBM 3270 communication link.

Programming Prowess

While about a third of the 137 electronics firms listed by the Israel Export Institute are in computer hardware and peripherals, with Elbit in the lead, there are over 100 dedicated software companies active in Israel today—and the list continues to grow. Approximately 7,500 computer professionals are employed in science and industry, about 2,000 of them in companies whose exclusive business is software. Total sales of software houses in 1983 were about $80 million, nearly all from the local market.

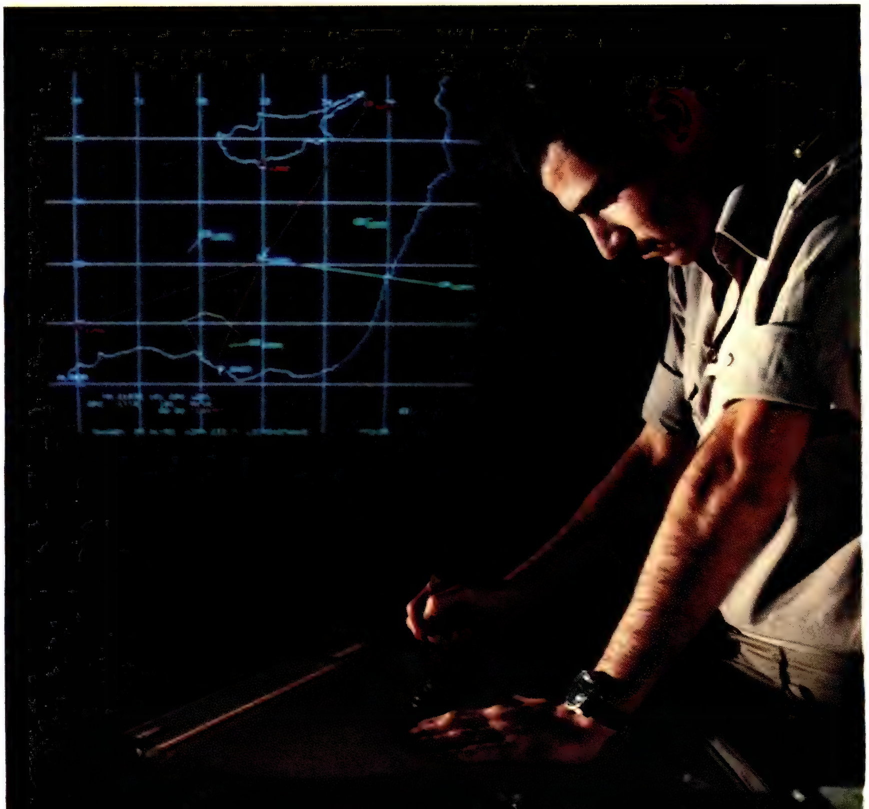
By 1970 almost every company in Israel with over 100 employees was utilizing computers for accounting, payroll, and inventory. Now these firms are advancing into office and industrial automation based on new developments in personal computers, on-line production control, computer-aided design and manufacturing equipment, and communications networks. Moreover, the defense market has added requirements in the areas of real-time software, avionics packages and command, control and communications systems.

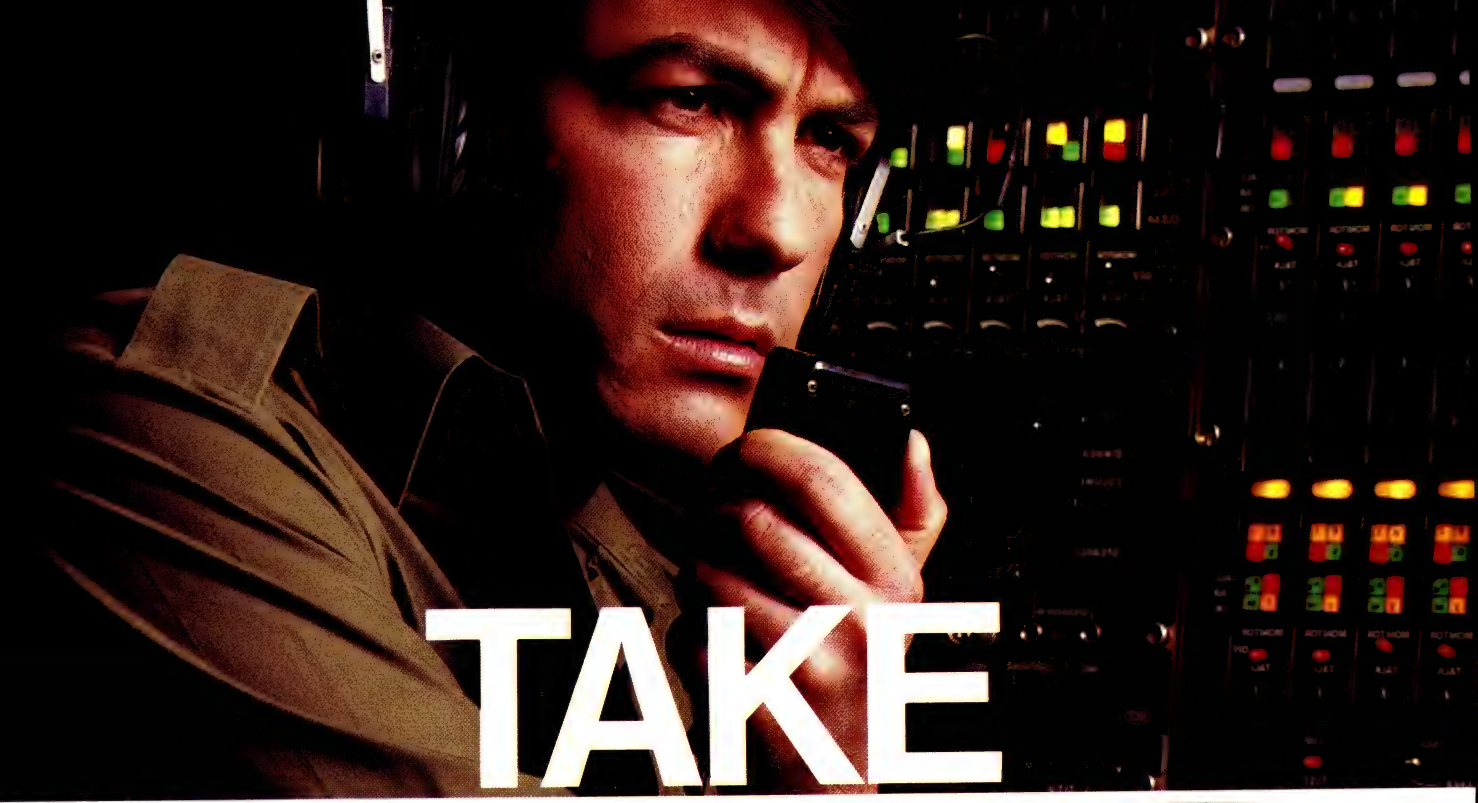
In meeting these local market needs, the software industry in Israel has reached maturity and is now to build export sales. Typical of the wares and services offered by a thriving community of software houses are programs in management applications from agriculture, architecture and banking through printing, real estate and travel—in short, programs covering every field of commercial endeavor.

Exemplifying the programmers, Largo Soft International focuses on specific industries, marketing packages for project management, finite elements analysis, and electronics design among others. Examples include HIGHCAD, which interfaces with Lotus 1-2-3, adding mainframe capability to the IBM Personal Computers for design of highways, roads, and airport runways; STARNET, which is based on BKN network methods theory for project management; and THERMAX, which is an interactive CAD program for heat-transfer analysis in pc board design.

Dov Sharon, Largo Soft VP for International Marketing, has established relations with ten of the

The color tactical display from Elbit Computers Ltd. is installed in a missile boat as part of a sophisticated command, control, and communications system.





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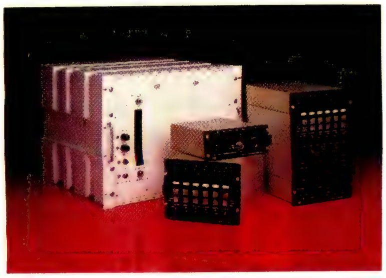

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Government agencies promote business

The Israel Export Institute is a nonprofit agency sponsored by the Israeli government to serve as an assistance center for both importers and exporters of Israeli products. The institute promotes Israeli products by participating in industrial fairs and exhibitions around the world; special product weeks in Israel focus on specific industries like fashion, metal, food, chemical, agriculture, and electronics.

Backing up the "made in Israel" label, the specialized staff of the Institute are there to serve. Inquiries can be addressed to the Commercial Attache at the nearest Israeli consulate or embassy. Inquiries may also be sent to the Israel Export Institute, 29 Hamered St., Tel Aviv 68125, Israel.

A second agency, the Government of Israel Investment Authority was specificaly established to provide one-stop service by coordinating the roles of governmental departments and public agencies and assisting foreign investors in all phases of their business projects in Israel. More literature about the Investment Authority can be gotten by contacting the agency in the US at 350 5th Ave., New York, N.Y. 10118 (or phone (212) 560-0610) or in Israel at 6 Pick St., Jerusalem 91034, Israel.

leading US CAD software vendors; already, sizable sales of THERMAX have been made to AT&T and Ratheon, among others.

Software In-House

Many of Israel's larger industrial firms have developed in-house software capabilities, especially those companies producing primarily for the defense market.

Elisra Electronics Systems, an affiliate of Tadiran, was founded in 1966 to develop and produce electronic warfare systems for the IDF. From sales of $1 million in 1968, the company's revenues have grown to $60 million in 1984, about 40% exports. Elisra invests 10% of revenues in R&D and, to support its electronic warfare development and manufacturing programs, has adapted and originated a wide range of computer software. Some of the applications are in microwave design, CAD, and data processing for electronic engineering, and automatic test support equipment.

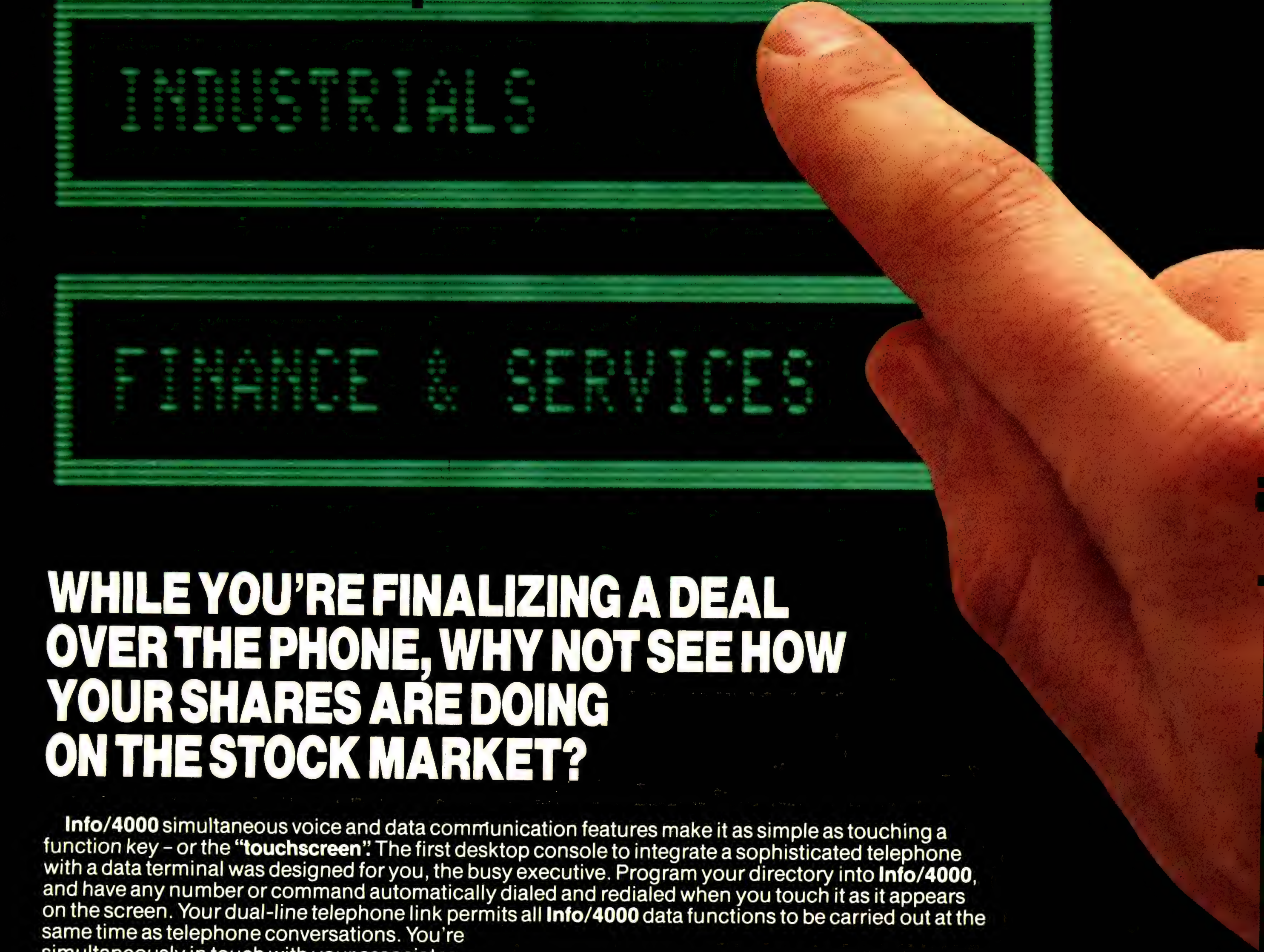
Another company with extensive software capabilities is Israel Aircraft Industries (IAI), the country's largest industrial firm, wholly owned by the MoD. In addition to aircraft production, IAI's five divisions are engaged in manufacturing a vast array of weapons systems and electronic warfare equipment.

The importance placed on production for defense is understandable when one considers that Israel has experienced six wars in her 36-year history. Until 1967 the IDF was largely dependent on foreign sources for weapons, and especially on France. When General DeGaulle banned further sales of defense equipment to Israel on the eve of the 1967 Six Day War, the die was cast for the drive to self-sufficiency.

Aircraft, missiles, tanks, ships, artillery—every modern weapon system is computerized; electronic warfare, signal intelligence, communications, radar, and optoelectronic systems employed on today's battlefields are at a level of sophistication undreamt of only 10 years ago.

Cogent examples are the Mini-Remotely Pioloted Vehicles (RPV) used for real-time battlefied reconnaissance by the IDF in Operation Peace for Galilee. Both Tadirans Mastiff and IAI's Scout were employed with great success. The diminutive drones weight about 135 kg, have a five-meter wingspan, and carry a gyrostabilized TV camera, onboard computers, an autopilot, and microwave data link communications gear.

Remotely controlled from a station up to 100 km in the rear, the miniature aircraft were able to monitor battlefield events for periods up to seven hours, providing field commanders precise real time intelligence on the enemy's order of battle. These RPVs were designed, developed, manufactured, and used in combat all in the space of



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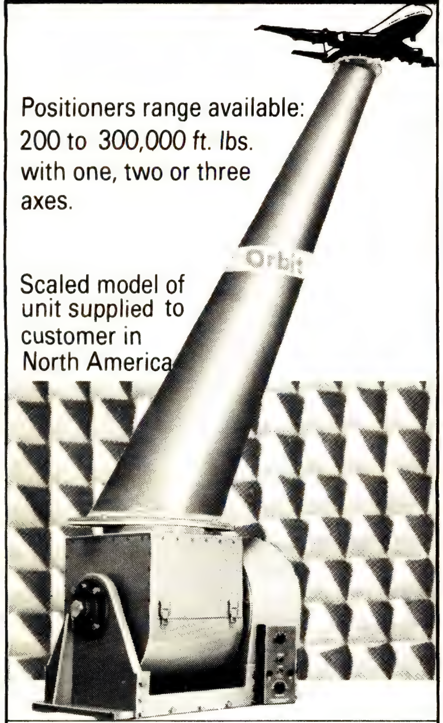

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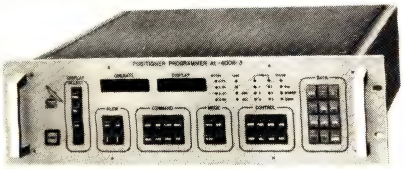

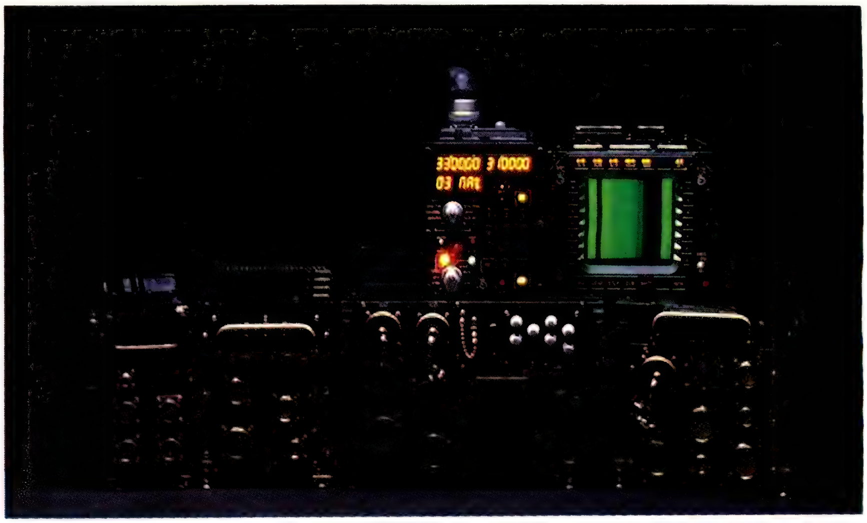

Elbit's weapon delivery and navigation system is in use by air forces all over the world. Like many of Elbit's other products, this system is a good choice for retrofit programs.

in development in the US and Europe for more than 20 years—none is yet operational. This summer, Tadrian and IAI announced the formation of a new company, MAZLAT, for joint development of RPVs. Meanwhile, the US Navy and Marine Corps were reported to have bought a number of the Israeli-made drones.

Three of IAI Electronics Division's units are involved in the design and production of military electronics systems. Elta designs and manufactures radars for aircraft, naval vessels, and ground forces, and an extensive range of electronic warfare systems. Tamam's inertial navigation systems are used in IAI's Kfir fighter aircraft, tanks, and other armored vehicles. MBT is famous for the development of the Gabriel anti-ship missile, credited with sinking some 17 enemy ships during the 1973 war. The weapons system plant is now working on the Barak vertical launch ship's point defense missile (PDM) system in cooperation with Rafael Armament Development Authority, an MoD-owned R&D house.

Rafael was established in 1948 as a special scientific unit attached to the IDF. Its mission then as now: improve, design, develop and produce weapons. 65% of Rafael's 5,000-man workforce are involved in R&D.

Defense system exports are more important than ever to Israel, providing a badly needed source of foreign currency. Cutbacks in the defense budget will amount to $300 million over the 1984 and 1985 fiscal years and 1985/1986 as the government struggles to revitalize an economy suffering from hyperinflation, huge budget deficits, and diminishing foreign currency reserves. Belt-tightening at home has compelled manufacturers to intensify their marketing efforts abroad and, particularly in electronics, these efforts are paying off.

Elbit, for example, reports a 44% increase in sales for the first quarter of the 1984/1985 fiscal year. The orders backlog for that period is over $270 million, more than 50% for exports. In July Elbit announced the award of a $10 million contract by General Dynamics for F16 fire control computers. The company also produces the Stores Management System and various cockpit displays for the F16. Avionics for fighter aircraft has been a major area for design and development at Elbit. System 82 Weapons Delivery and Navigation System (WDNS) for the Kfir C7 is the latest in a line of WDNS that equip IAF Phantoms, Kfirs, and Skyhawks. Demand for Elbit's command, control and communications systems and simulators has also been high. The Belgian Navy recently contracted with Elbit for its Combat Information Center Procedural Trainer after competition with Ferranti and Hollandse Signaal.

Elbit's weapon systems include tank fire control systems, optoelectronic devices, and a wide range of sensors and controls. The motto "Battle Bred" is used to describe this equipment with good reason: it was developed and refined based on direct feedback from the IDF troops who use it combat.

Tadiran's line of C⁴I systems for export include computer-integrated air defense, divisional artillery come and and control systems and other large scale projects. The company has been especially successful in exporting its military communications equipment. Last year Tadiran was awarded a $42 million contract for production of VRC-12 vhf tactical radios for the US army and expectations are high for brisk sales of the recently developed vhf-88 series of frequency hopping tactical radios.

Capable of operating in dense electronic warfare environments, the VHF-88 provides clear and secure voice and digital communication modes covering 30 to 88 MHz in 25 kHz steps; it has 2,300 channels, 10 of which can be preset. Various configurations are achieved through the use of interlocking modules, assuring simplicity of operation, testing, and maintenance.

Elisra exports nearly half of its military production, including airborne electronic warfare systems for fighters and helicopters; naval electronic warfare for vessels of all types and sizes; and communication systems jamming equipment. Elisra's airborne Systems Division recently completed development of the GPAP-1750 family of computers that conform to US MIL STD1750A-1, which means that they use Jovial 83 language and are compatible with US-made military aircraft.

Tip of the Iceberg

The computer has been approved by the US Air Force Architecture Test Program at Wright-Patterson Air Force base. Among the many foreign manufacturers to submit computers for approval, only Elisra and one other were successful. In fact, with its high throughput of over 650,000 operations per second, the GPAP-1750 had the highest processing speed of any system submitted test.

In October, Elisra announced the signing of a contract with Switzerland to develop and supply mobile automatic test equipment for ESM systems. Elisra won the bid in competition with several large American and British manufacturers.

Manufacturers of defense electronics in Israel will get a generous slice of the three billion dollar Lavi combat aircraft program. Hundreds of the new fighters will be produced in the late 1980s to replace Kfirs, Phantoms, and Skyhawks in the Israel Air force.

IAI is prime contractor for the project; Elta is prime for electronics. Elta is developing a new multi-mode pulse doppler radar, the self protection ECM and communications systems. Stores Management System, and standard modules for other aircraft computers. Elect-optics Industries, a Tadiran subsidiary, will manufacture the wide angle HUD.

Scores of other electronics subcontractors will be involved in the development and production of avionics, flight control systems, ECM, radios, and automatic test equipment. The Lavi program will provide thousands of jobs in Israel and not a few in the US, where companies like Grumman, Bendix, Garrett AiResearch, and Pratt& Whitney are heavily involved in the project.

Although the defense sector continues to employ the greatest number of electronics professionals, the civilian sector is growing rapidly. A vast market for information processing, data communication and industrial automation is just now beginning to appear, the tip of the proverbial iceberg.

Israeli software and computer expertise, the traditional multi-disciplinary approach to problem solving, dedication to R&D, and an accommodating industrial base will lead to a marked rise in commercial export sales in the next decade. Whereas in the past the developing nations have been Israel's primary clients, today's major markets are in the US and Europe, and this trend is expected to accelerate.

Electronics has proven to be a recession-proof industry; its continued expansion will play a leading role in Israel's recovery and the securing of her economic independence. ☐

Mel Kessler, the author of this section, is a retired US Air Force Major now living in Israel and engaged in freelance writing on a variety of technical and defense-related topics.

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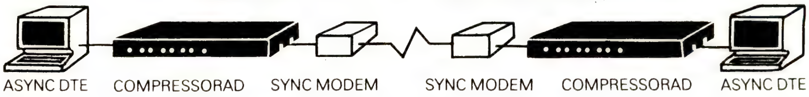

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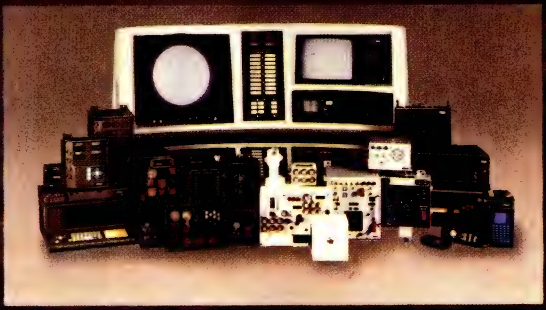

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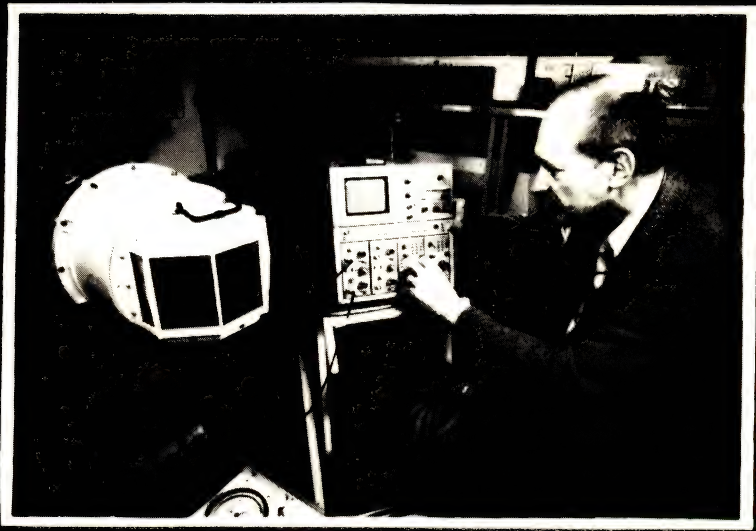

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088

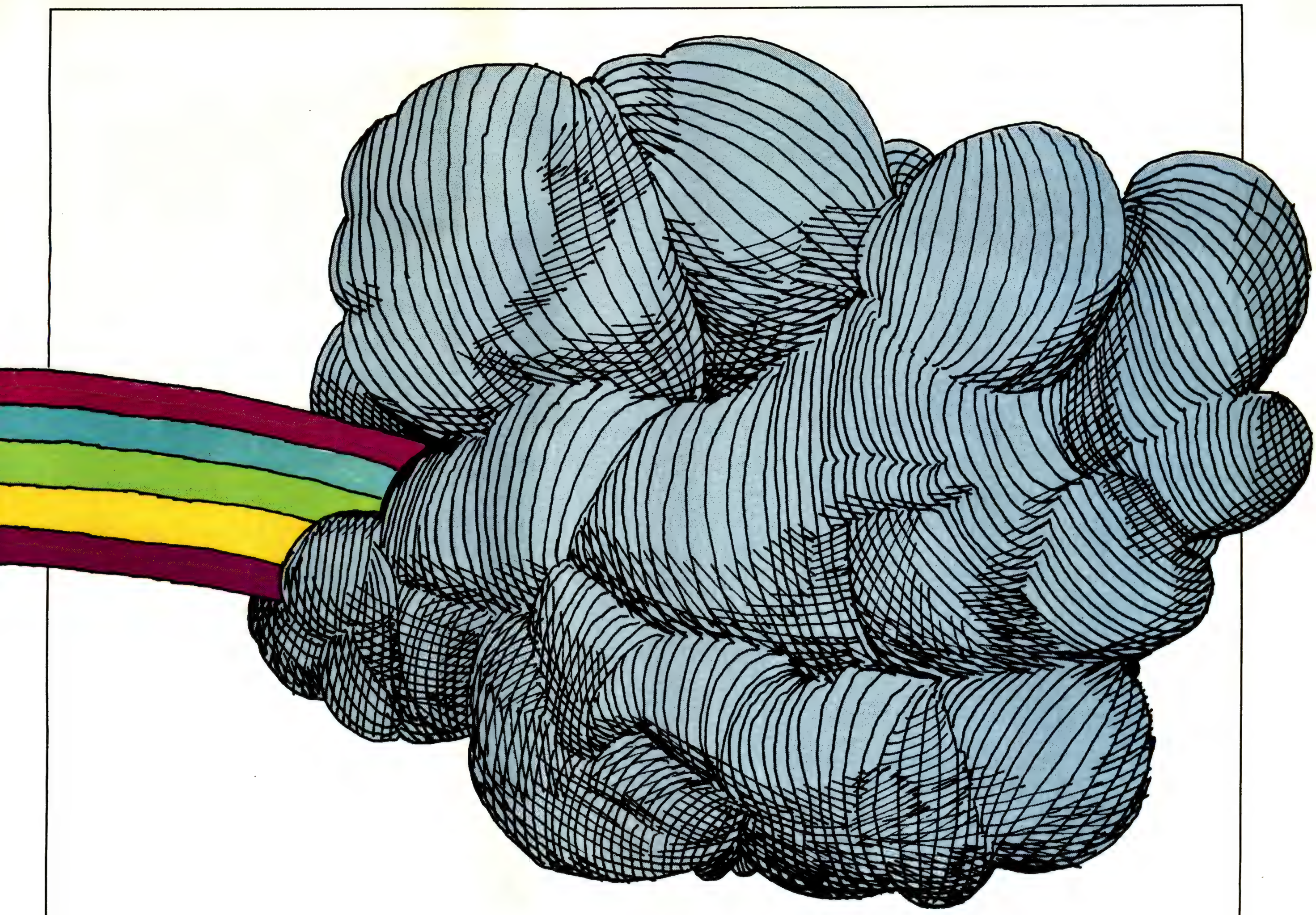
EXECUTIVES SEE FAIRLY SMOOTH ROAD IN 1985

But threats of deficit, interest rates, and cooled-off recovery late in year could turn outlook of industry leaders gloomy

Will there be recession, growth recession, or continued recovery? Will it be tax reform, tax increase, or tax decrease? Will interest rates go up, down, or nowhere? Will there be a budget freeze? Will the federal deficit shrink, swell, or swallow us all?

As President Reagan begins his second four years in the White House, those are just some of the questions furrowing brows in the executive suites at many electronics companies. And putting the economy aside, there is enough uncertainty in other critical areas—foreign policy, for one, with particular attention on the Middle East and Central America—to propel the people who make the decisions toward the aspirin bottle. One thing is certain: it is definitely not the best of times for the crystal-ball industry, at least.

But even though *ElectronicsWeek*'s annual Executive Outlook survey of what's worrying the top men has turned up more than enough concerns to go around, there is a feeling of subdued optimism running through the top-floor corridors. In fact, the consensus seems to indicate that although the growth phase that the economy has experienced in the



past year will slow or stop, there won't be a recession.

It is interesting to note that the electronics executives questioned are not alone in that optimism: their counterparts in other industries generally agree that slowdown does not equal slump. And also sharing that view is a gaggle of economists, who lean to the belief that there will be what they are terming a growth recession, which is a cooling-off period, rather than a full-fledged recession, which carries with it a decline in the gross national product.

Such an attitude on the part of executives and economists alike is admirable, if not remarkable, considering the indecisive state of the movers and shakers—those who have the economy in their hands—both in the Congress and the executive branch as they seek the correct path.

Consider what has gone on since Election Day. The Treasury Department has come up with its plan for what it calls a tax cut—although the cut for many of those in the middle and upper tax brackets would consist of a slice out of the wallet—that ignores the projected $210 billion deficit. And that was just the first trial balloon. Then came a report that the President favors what is termed a budget freeze—except for defense and Social Security—as a means of bringing the deficit down to $100 billion in 1988.

To add further to the initial economic feeding frenzy, the experts early on couldn't agree on the relative importance of deficit reduction, interest-rate cuts, low inflation, and holding down unemployment. But that confusion was followed early in December by the news that congressional leaders want to attack the deficit as the first order of business. After that, nothing is sure, except that there will be other plans.

Thus it is no wonder that a closer look at the worry list covers a territory ranging from one end of the economic spectrum to the other. There are the predictable concerns about the nation's huge deficit and the direction of interest rates, but also prominent is trade—executives on both sides of the Pacific mention it—and its companion, competition. Overseas, there is worry about a decline in competitiveness in Great Britain and the high book-to-bill ratio in the semiconductor business.

Focusing on that bellwether industry, it would appear that clouds are gathering and the days are getting shorter as estimates of 1985 market growth come down. Those estimates now range from a pessimistic 7% or 8% up to 15%, itself quite a reduction from the 30% that some were broadcasting last summer. Even those figures are suspect to some. As Mostek Corp.'s Harold L. Ergott Jr. sees it, forecasts of demand are muddied by overly optimistic predictions from computer and systems houses looking for an edge in a highly competitive and strikingly volatile selling environment.

In any event, 1985 will not be a dull year for economists—or electronics executives.

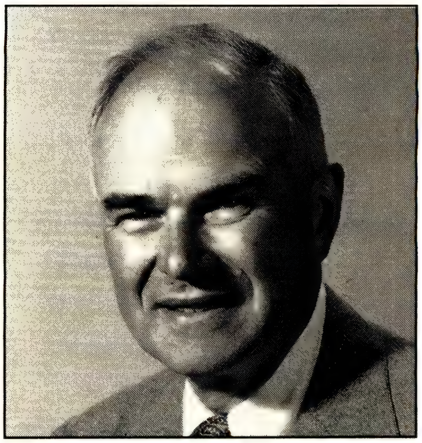
W. MICHAEL BLUMENTHAL
chairman and chief executive officer, Burroughs Corp.

If there's one big cloud on an otherwise sunny horizon from Blumenthal's perspective, it's the size of the federal budget deficit and the possible impact it could have on economic conditions worldwide, says the Detroit executive, who served as Secretary of the Treasury in the Carter Administration. If the problem isn't adequately addressed, it could lead to a recession in this country and to further problems in the exchange rates between the U.S. dollar and foreign currencies, he says.

As a result, says Blumenthal, "We are very anxiously looking at Washington and at the President's program, now that the election is behind us. And that's sort of a major unknown."

With that disclaimer, Blumenthal sees good times ahead for the computer business. Despite the moderation in the general economy from its post-recessionary spurt during the first half of this year, he says that "we do not feel it in our orders or in our revenue at this point." Given the continued appeal around the world of computers as productivity tools, he sees no reason why the strong demand should not continue. "We don't see any signs of abatement, even though the general economy is slower."

On the question of interest rates, Blumenthal is rather sanguine. "I think that as the economy is slowing down, interest rates will ease somewhat more and then stay fairly level for a period of time," he opines. "Only if there were a lot of deficit financing and tighter money again would you see interest rates rising, and that doesn't seem to be in the cards again for a while at least. So I don't really see any reason why interest rates would go up."



JOHN C. BIERWIRTH
chairman and chief executive officer, Grumman Corp.

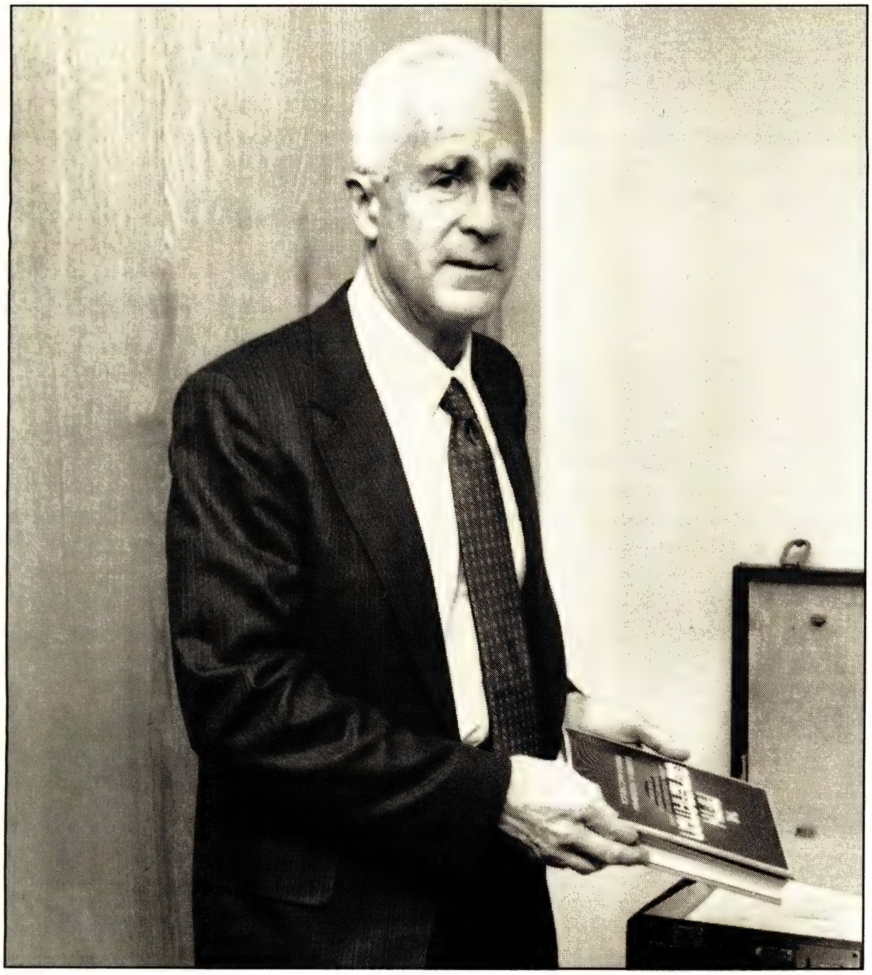
Although he says he is reassured by President Reagan's re-election, chairman Bierwirth still worries about the impact of a federal budget deficit officially projected to exceed $200 billion by fiscal 1986. "The question is, can we pull back on our deficit and not do enough damage to the rest of the world to start an economic collapse?"

Bierwirth disagrees with some economists who claim a recession is already under way. "No, I think economists are wrong, because I think that you're seeing a decline in interest rates that will pick up sales in housing and automobiles. There's a pent-up demand there, and I think as a result you'll see the economy lift back up a little bit."

Despite predicting a "real shot" at a modest recovery that could extend into 1986, Bierwirth remains pragmatic. "The business recovery we [now] have in the U.S. obviously cannot go on forever."

Overly optimistic growth projections are responsible for the overheated semiconductor industry, Bierwirth thinks. But he doesn't see this as a long-term problem. "The future is obviously wrapped up in advanced electronics and we're going to have fits and starts between here and there."

"There's going to be a lot of [semiconductor industry] competition, there are going to be a lot of people who overexpand and have indigestion for a short period of time. But the growth is so inevitably there that even the people who get indigestion will very rarely regret it for very long."



WILLIAM R. THURSTON
president and chief executive officer,
GenRad Inc.

The electronics industry has become a bipartisan issue, says Thurston. Because both parties appreciate the role of high technology, he says, "We're election independent for the moment." More relevant than elections per se, in his view, is the effect politics will have on economic problems.

For example, Thurston says it won't be possible for President Reagan to capitalize on his election landslide and move quickly to reduce the deficit. "The fundamental problem is that the politicians do respond to the voters' short-term perceptions," he says. "[Those] perceptions are not as influenced by the deficit as by the things that would need to be cut or by a tax rise [that might be needed]."

So Thurston anticipates nothing will be done about the deficit before it creates further problems within the economy. Thus the upcoming year, he says, will likely be one of slower growth and a modest increase in inflation. An early slowdown sign, he says, is the current drop-off in the semiconductor business.

Though growth rates will be reduced, the position of automatic test equipment as a keystone sector of the electronics industry should continue. Thurston says this means the ATE segment will continue to grow at a rate greater than the industry as a whole, "because of its key role relative to quality, which is a trend—a strong trend."

As in other slowdowns, newer products will do better than older ones, he says. Keeping the bad news in perspective, however, Thurston repeats an old industry maxim: "When [the electronics business] is good, it's very, very good. And when it's bad, it's still pretty good."

GENE ORI
general manager,
Discrete Semiconductor Group,
Motorola Semiconductor
Products Sector

Despite enjoying an excellent 1984 in discrete components—sales leaped 30%—the veteran executive, like others at his level in the industry, has more questions than answers about 1985. "You have to be concerned about the coming year at this point," Ori admits. Projections for semiconductor sales growth currently center in the 15% to 20% range, he says. If that holds true, then discretes could increase by 5%, quite a drop from the 1984 figure.

The major trend in his business is clear, according to Ori, who also holds the title of Motorola senior vice president. "It's the integration of more components into single chips, which is a continuation of the present." But technology improvements are coming, too, and firms with a stake in this field must make investments, or else.

Being in discretes also demands a management approach somewhat different from other semiconductor parts, in Ori's view. "You have to be more relentless," he advises, which means doggedly sticking to executing plans, even when times get tough—which, points out Ori, could well describe next year.

Those in the discrete business also must keep an eye peeled for more Japanese competition, since these products often already are manufactured in Japan and can be exported easily. This is always a concern of the Motorola official, who has seen too many results of such competition in the past.

SIR KENNETH CORFIELD
chairman and chief executive,
Standard Telephones & Cables plc

On the global level, not only is Corfield not worried very much about the world economy but he is encouraged by the U.S.'s renewed self-confidence. On the other hand, the electronics industry in Britain is heading for a bumpy ride, predicts Sir Kenneth, whose group, with sales of $2.6 billion, became one of Britain's largest electronics outfits this year when it bought International Computers Ltd., the country's flagship computer maker.

"I was delighted with the President's re-election. Reagan is what America needs," says Corfield. He is not concerned that the sky-high dollar will nosedive and drag the U.S. economy, and with it the whole world economy, into recession. He envisions, instead, a dollar devaluation of around 12% to 15%. "You have to ask yourself, where else would you put your money?" says Corfield. He predicted the dollar's rise, and he believes in its long-term strength: "The dollar will be on parity with the pound by the end of the decade."

What does concern him is the declining competitiveness of UK industry. True, the small-company sector, particularly personal computers, is showing a new-found entrepreneurial flair. But the trade figures point in the other direction. "In five years, Britain has moved from a trade surplus of $600 million in electronics to a deficit of $2.3 billion." In spite of a growth of 10% to 12%, the supply side was not keeping up with the growth in the UK market, let alone the international market.

The government cure is a medicinal dose of privatization—notably with British Telecom. "Such privatization offers great opportunities for Britain, and great risks. We have to face it," says Sir Kenneth. "Otherwise, the relative decline of the economy will continue." British Telecom will buy from overseas suppliers, but their share should be sufficient only to keep UK companies honest. Also needed is a "healthy relationship between manufacturers and operators. Manufacturers, and not customers, should design products. They should develop products not only for British customers but also for world markets. The UK has not enjoyed such a relationship with British Telecom until recently."

HAROLD L. ERGOTT JR.
president,
Mostek Corp.

Believing that the state of semiconductor markets is even beyond the power of a presidential election to alter, Ergott has been expecting good times to continue during the next two years. But he cautions that scattered weaknesses will probably appear in several recession-prone segments.

That kind of outlook is less likely to give old-line chip houses difficulty, says the president of the United Technologies Corp. subsidiary. But, he adds, many startup firms stand to see their niche markets evaporate or level off in growth, causing them more difficulty in the coming year. The trick has been identifying those market segments that will remain on a steady growth path in 1985 and 1986. Once that is done, Ergott says, volume manufacturers must hope for the better.

"For any device in significant quantities—if you want to be cost effective—you really have trouble turning large volumes on and off quickly for many reasons," he notes, citing the difference in processing technologies and equipment for various types of integrated circuits. "So I think the people that are in the best position to be profitable are those who are now positioned in the market and can ride into changes, as opposed to doing it in step functions."

The rub lately has been getting a good handle on the potential total of chip sales, he states. No longer are integrated-circuit makers able to assemble solid forecasts from the purchase projections of their customers. Ergott, like many other semiconductor executives, complains that the outlook in actual demand has been clouded by overly optimistic forecasts from systems and computer vendors, each of which hopes to capture significant shares of emerging markets. This twist in forecasting volumes has been most evident lately in the fickle personal computer market, he adds.

"Looking at this, people here have made a lot of judgments on which customers they want to serve and which ones they do not," states Ergott. "I think the [chip] startups that were buoyed up by these forecasts are going to have difficulty when the users [computer and equipment makers] start shaking out."

PHILLIP W. ARNESON
president,
Amphenol Products unit,
Allied Corp.

For the man who oversees operations for the connector industry's second largest supplier, concerns include the potential for emergence of "an interest-rate psychology that could create a self-fulfilling prophecy and force interest rates up." However, he adds, Federal Reserve Board monetary policy will be the biggest influence on rates. "The heavy deficit spending is obviously going to continue in the short term, so we're going to have interest-rate pressure in the economy."

Arneson also worries about a slowdown in the rate of technology startups during this year's second half and the increasing bankruptcy rate among fledgling firms in recent years. High interest rates in 1985 could exacerbate the problem and lead to a slowdown in the emergence of entrepreneurially spawned innovations during 1986 and 1987 and beyond.

Still, he says, "We feel it's going to be a pretty good year." At worst, Arneson sees industry order-run rates holding in 1985 at a level about equal to this year's second half. And there are signs, he says, that business may even head back up after moderating somewhat from 1984's first six months.

Continued strength in capital spending for modernization and productivity improvement bodes well for suppliers of robotics, industrial computer-aided-design and -manufacturing equipment, instrumentation, and computers. And on the office-automation front, Arneson says that the market may be ready to break out of a recent lull caused by a resegmentation in the computer business. There has been a "standing back" by suppliers in introducing new office-automation products and by buyers due to a need to assess the effects of personal computers, networking systems, and other new kinds of equipment invading the white-collar workplace. "But if interest rates continue to stay in the single-digit range, the holding-back period will end in the next several months and we'll see a new demand cycle begin by the second quarter of 1985."

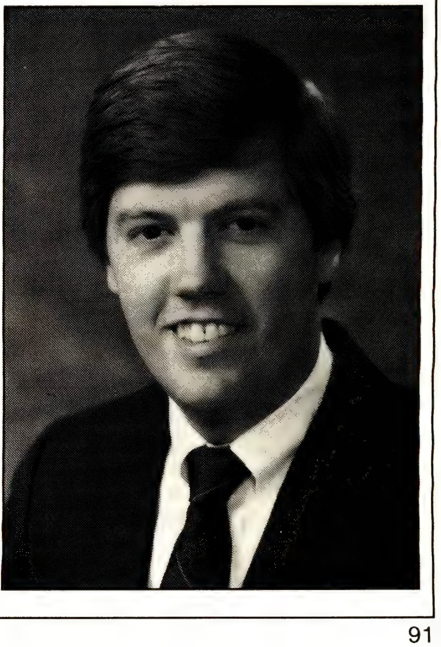
SCOTT McNEALY
president and chairman,
Sun Microsystems Inc.

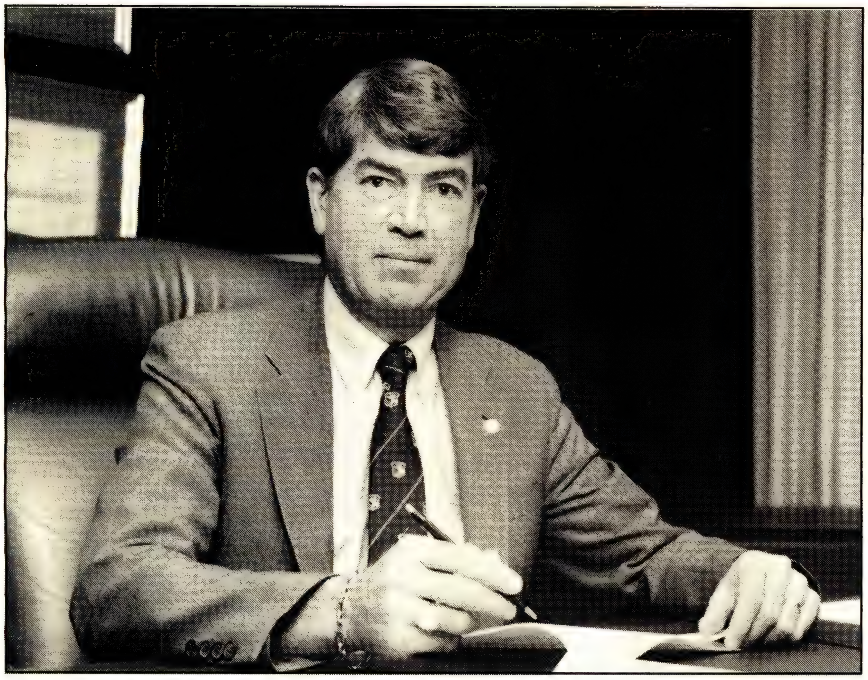
With his two-year-old company doubling in size every six months, along with the rest of the engineering-work-station industry, it is no surprise that McNealy's major concerns center on competition. He sees few economic problems on the horizon. "I don't spend a lot of time watching interest rates," McNealy says. "It's true that the lid is on capital expenditures, but productivity tools like work stations seem to fit under the lid."

McNealy expects IBM Corp. to come chugging into the work-station market next year, adding that "any market they enter is a different sandbox thereafter." However, he continues confidently, "IBM has never sunk a well-managed company."

Digital Equipment Corp., too, is a likely entrant, McNealy says, since it already is a favorite of technical professionals; however, he notes that both of these established companies will be playing catch-up technically with the small firms that have been in the market for two or more years.

The slowdown in the semiconductor industry that occurred during the fall does not necessarily mean trouble for the rest of the electronics industry, McNealy says. In fact, "It even helps us," he notes. The reason as he sees it: "Components are now available and prices are down."





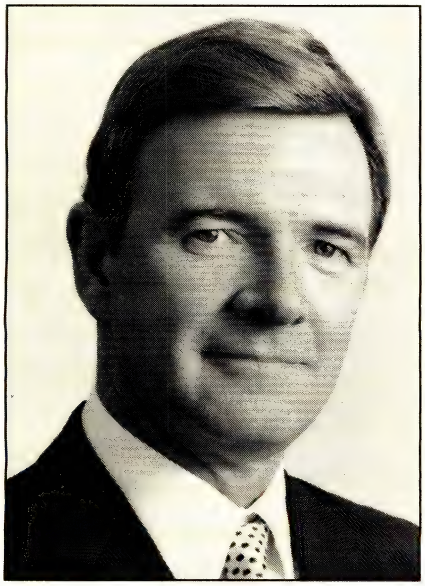
ALLAN RAYFIELD
president,
Diversified Products & Services Group,
GTE Corp.

Not only is Rayfield concerned about the federal budget deficit, but he also worries about the revenue-generating schemes the Reagan Administration and Congress may come up with. He is particularly concerned about their impact on recent accelerated depreciation legislation that Rayfield says is important to the telecommunications industry. "That's a thing I think we'd really hate to lose or get set back on—particularly in our kind of business, with change in technology going so quickly." Overall, Rayfield acknowledges that the recovery has slowed, but predicts "acceptable economic growth" into the second half of 1985.

Rayfield, who is also senior vice president of GTE Corp., believes President Reagan's re-election will continue the trend toward deregulation of the telecommunications industry. "The continuing deregulation of AT&T, if it's put in place before competition really has time to develop in the long-distance market, may frustrate that industry. That's of grave concern to us."

As for the future of the telecommunications industry, Rayfield is enthusiastic. "One of the most competitive and exciting areas in the next few years is going to be in the private networks and the interconnect area—private branch exchanges, work stations. That's going to be a tremendously competitive and exciting business. I suspect that's the place where we may see the largest change in both equipment and telecommunications."

And, with fierce competition ahead, Rayfield adds, "It'll be a tough place for a while to make a living."



GORDON H. MATTHEWS
chairman,
VMX Inc.

No matter which way the fickle economy turns, Matthews asserts, both productivity and costs are sure to be prime concerns for businesses through the rest of the decade. But aside from that, for Matthews, 1985 has a rosy glow. He believes that his Richardson, Texas, company, which manufactures voice store-and-forward systems, will be at the center of the productivity revolution as voice-messaging becomes a more important feature in private-branch-exchange markets. That need is driven by pressures to bolster white-collar productivity and cut communications overhead.

"It is almost no longer an option," he explains."Companies are now starting to look at voice messaging in the same way they do their mail and normal phone systems. I have been told by executives in the PBX business that they cannot even submit bids for corporate contracts unless they are able to check off the square that indicates voice messaging can be made available."

Automatic networking of remote voice-mail systems, further integration into office switching equipment, and mobile cellular-radio phones are promising still more changes in messaging systems and software, Matthews predicts. "I think it will have an early maturity, but there are still a lot of changes ahead in the next 24 to 48 months in terms of new features and downsizing the equipment," he adds.

And cellular radio will make telephones more accessible to mobile professionals, leading Matthews to predict that it will also present a need for more messaging capability. "In making a long-distance call, you only have a 25% chance of reaching a person on the first try. By leaving a message you can reduce the cost of calling each other back and forth as well as improve overall productivity," he suggests.

JOHN W. DIXON
chairman and president,
E-Systems Inc.

Although the landslide re-election of President Reagan might be expected to provide a vote of confidence to the defense industry, Dixon still believes military-electronics houses have a major concern in another important campaign looming ahead: to persuade the U.S. investment community to stop measuring fiscal success on a quarter-by-quarter basis.

"It seems to me to be getting worse," complains Dixon, who believes the short-term outlook of U.S. investors is particularly tough on firms competing in the advanced electronic-warfare business. In the command, control, and communications (C^3) markets, system contractors are faced with making costly investments for the future, Dixon notes.

"This industry has traditionally been a highly labor-intensive business, but it is becoming much more capital-intensive lately," he says. "And these investments are necessary to allow us to keep up with the fast-moving electronics competition."

For electronic-warfare and C^3 markets, the pace is expected to remain brisk, regardless of who is in the White House, says Dixon. "So, from the broadest sense, [the Reagan victory] is a good omen for the entire defense business, but to us it will make little difference," he adds.

What defense-system makers are wary of, however, is the availability of materials and components. Wild swings in commercial-electronics demands have in the past caused some shipment delays to military vendors, Dixon says. But topping attention lately have been delays in deliveries of military semiconductors due to a crackdown on improper testing procedures. "We have been seeing some delays, but they are on the order of only a couple of months, which is not a real problem," he says. "But it is a worrisome thing."

JACQUES NOELS
director,
Components Division,
Thomson CSF

Noels expects that after a sparkling 1984, the components market is about to go into its usual cyclical tailspin. However, despite the industry's generally falling book-to-bill ratio, Noels is optimistic for 1985, not least because components houses have enough orders on hand to see them through the year with a comfortable rate of growth.

But the essential difference that he sees in this market downturn is that semiconductor manufacturers in general, and integrated-circuit houses in particular, are finally showing signs of being able to manage supply and demand during market upswings in order to blunt the effects of the downswings. "If you look at previous cycles, there was a supply delay at the peaks of as much as eight months," Noels points out. "This time, that figure never went above five and a half months. The reason is that components manufacturers were better able to allocate their production capacity so as to avoid becoming overcommitted."

Noels feels that a prime example of this phenomenon is the personal computer market, where IC houses have begun regarding overzealous orders with a certain amount of healthy skepticism. "An order from IBM for 1 million pieces in six months' time you can consider as 100% sure," he explains. "But maybe, if it comes from a small manufacturer, you take it at something less than face value, because of over- and double-ordering that happens whenever delivery dates start getting pushed back by components manufacturers.

"At any rate, the net result is that the cyclical nature of the business is still with us, but that the cycles are getting somewhat shorter," Noels reasons. "That simplifies planning and points generally to a business environment that is fundamentally healthier than before."

HERMANN R. FRANZ

*senior vice president,
Siemens AG*

"Not bright but good." That pretty much sums up the prospects that Franz, who heads his company's Components Group and is a member of its board of management, holds out for West Germany's semiconductor industry. And given his familiarity with conditions elsewhere in Europe—where most of Siemens's components sales are—this assessment should hold for Western Europe as a whole.

Specifically, what Franz foresees is that the semiconductor business, after having pulled out of the 1981-82 slump and chalked up a record year in 1984, will slow down a bit but still move at a fast pace during the remainder of this decade, growing at better than 20% a year "even if a recession should hit us." With heavy impetus already coming from the information-processing industries, "the automotive sector and measuring-and-control field are also developing into areas of strength."

Franz is also optimistic about other developments. "The climate for high-tech firms operating in Germany will keep improving, what with the anti-technology attitudes, formerly strong in many quarters of German society, on the wane. By and large, the times when high technology, microelectronics, and automation were considered the devil's work are all but over," Franz says.

For all his optimism, though, Franz is not without some apprehension. One is the uncertainty over the U.S. monetary situation, particularly the way the interest rates will go, the fiscal policies, and the relation of the dollar to other currencies. "A strong dollar is good for us, a weak one is bad," he says.

Franz is also apprehensive over "voices in the U.S. Congress that for reasons of national security promote restricting much high-tech electronic equipment and other products to domestic consumption. The climate that such thinking fosters is not good for free, international trade," he says.

In chorus with most other top German executives, Franz is a strong advocate of free trade at home as well. "Why should not a few U.S. and Japanese firms operate here?" he asks. "We are in their markets and they are in ours. Competition keeps you running, and the overall effect of such a give-and-take situation on the industry and economic well-being can only be positive."

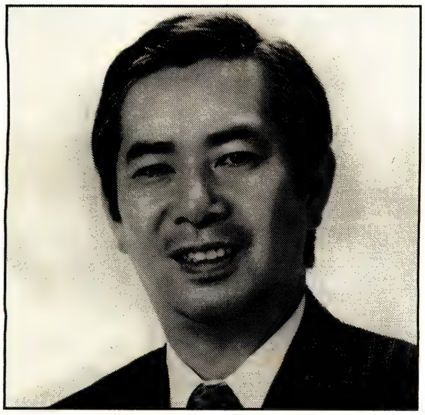
B. R. INMAN

*chairman and president,
Microelectronics & Computer
Technology Corp.*

With research and development cooperatives now expected to proliferate across many segments of the electronics industry, companies will face a new challenge beginning next year in transferring technology from the consortium laboratory to their own product lines, predicts Inman.

"There are plenty of problems when companies move research from their own laboratories and attempt to fit it into a business strategy. But there is yet an extra complexity when it is done from a joint research venture," Inman suggests. "In these cases, firms cannot decide their own convenient time to use technology because it is being made available to sponsoring competitors as well. That means top management has to trace it more closely, and once ready, place it quickly into their business strategy."

With MCC and other R&D cooperatives now running, Inman believes skepticism over such consortiums has subsided throughout the industry. "We have clearly established that you can draw first-class talent because [consortiums are] an appealing environment for researchers who do not have to argue with a comptroller to keep their programs alive. They also will not be pulled off research to save this year's trouble product," Inman states. And with the enactment of the National Cooperative Research Act of 1984, Inman says, antitrust clouds have cleared. He now expects to see many startup R&D ventures in a number of U.S. industries.



KAZUO KUBO
president,
Sharp Electronics Corp.

Innovation, says Kubo, will be the key to success for electronics manufacturers in 1985. "That is *the* most important thing. By creating new, innovative products [manufacturers] can also create a new demand."

Kubo, who became president of Sharp's U.S. operations in Paramus, N.J., a year and a half ago and is now overseeing a major expansion of those operations, is somewhat reluctant to discuss the U.S. economy in terms of political issues, such as President Reagan's re-election or the growing trade deficit. Generally, however, he believes the current recovery will continue to benefit the entire worldwide electronics community in 1985.

"The biggest reason is that we already have the proven record of four years of the Reagan Administration, which has led the U.S. economy to a very strong position." The President, he continues, "made it possible to expand the American economy. I believe that Mr. Reagan [will] continue to be the leader of the world economy," says the Japanese executive.

Kubo downplays the long-term significance of the current slump in the semiconductor industry, emphasizing instead that the business hasn't yet reached its full potential. "So you might see a temporary slowdown, but the semiconductor business itself has a great future."

IRWIN RUBIN
chairman and chief executive officer,
Computer Memories Inc.

The Winchester disk-drive business faces a grim 1985, Rubin believes, with uncertain demand that can trigger price wars and sink under-financed firms. Calling the tune are four major customers—IBM, Apple, AT&T, and the Japanese—so "you have to anticipate what they want."

Rubin's best guess for a unique product that could be produced at a profit for the next generation of microcomputers would be a drive with at least a 40-megabyte capacity and an access time faster than 40 ms. The competition is so fierce that chief executives at drive firms face the prospect of betting their company on getting a major contract.

Rubin knows all about this, having landed the plum award: supplying 20-megabyte drives for IBM Corp.'s Personal Computer AT, at present the hottest machine around. His firm therefore is set for the looming shakeout of disk firms, which could go under at a steady clip during 1985.

But the executive by no means lacks worries. For one, the Japanese are coming into the U.S. market at full tilt, led by Fujitsu. Too, financing growth is a headache, given that the public equity markets stay closed to high-technology firms. He is therefore concentrating on basics, "making enough drives at a profit, and as much as possible offshore."

JAMES F. TORESON
president,
Xebec Corp.

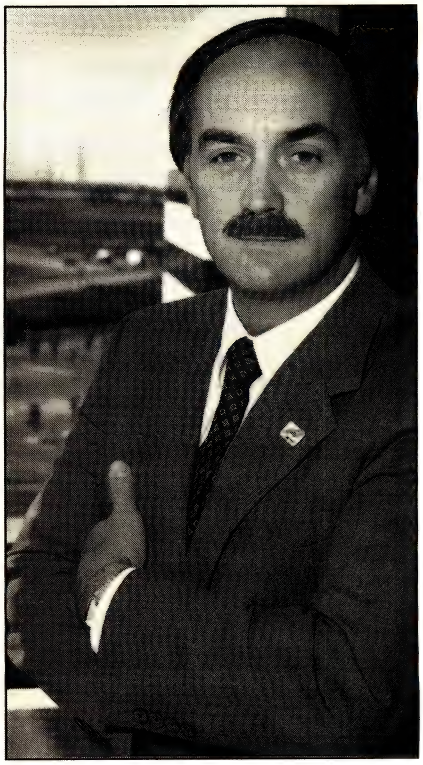
More than any short-term economic problems, more than budget deficits or high interest rates, Toreson worries about what he sees as the willingness of U.S. firms to trade production technology for profits. Short of a major recession, Toreson expects the small-computer industry to flourish.

"I have a hard time figuring out what Ronald Reagan did for the business climate, but it seems to be working," Toreson says. "I don't worry about a recession. What I see as the biggest problem for U.S. industry is the failure of large companies to practice what made us successful in the first place: to manufacture products. To once again be a producer of goods." If U.S. firms continue to take the route of offshore manufacturing, Toreson says, "whatever happens to interest rates, we will suffer both economically and in terms of national security."

Toreson, whose San Jose, Calif., disk-drive maker has invested heavily in automated manufacturing, would like to see tax credits for such investments. The alternative, he says, is for Japanese firms to "come in and manufacture our own technology right under our noses." Toreson notes that while many U.S. firms are manufacturing and assembling products overseas, Japanese firms are building plants in the U.S.

The U.S., Toreson says, has suffered declines in its textile, steel, and automobile industries because companies were tied to short-term profits. With a tax incentive to automate, he adds, "CEOs will go for the tax break instead of looking to the Far East."

Toreson expects the current trend of mergers in industry to continue. "We're in a stage where the big are getting bigger. There is a massive consolidation going on. That's not entirely bad because the real economic enemy is the Japanese—not each other."



GILBERT F. AMELIO
president,
Semiconductor Products Division,
Rockwell International Inc.

That prospects for semiconductors can change literally overnight is a fact of life. But when the rosy projections of a year ago turned dark in late summer, clouded by the sudden fade in the personal computer boom, even top industry officials were caught off guard, Amelio observes. "We all knew it would happen sooner or later, but not so quickly."

Curiously, the Rockwell executive does not expect the softer semiconductor demand to be caused by a sharp decline in the U.S. economy itself. "It should be a generally favorable environment, with interest rates stable to down." The deficit and whether anything significant is done about it will remain open questions for some time, but will have little further impact on business in 1985, in Amelio's view.

Amelio's foremost concerns for the future stretch beyond 1985 and deal with financial considerations, "particularly overinvestment and overcapitalization not warranted by demand." At point is a worrisome comparison: "Ten years ago a $1 investment brought back $5 in sales; today it's $1 for $2 and may go lower." The U.S. semiconductor industry has to work harder to improve these ratios, which are closely tied to yield and profitability, he says.

JOHN W. PODUSKA
president
Apollo Computer Inc.

Because Wall Street watchers would start mumbling about a slowdown if his company merely doubled revenues in a year, says Poduska, he operates at a level of success that apparently breeds an optimism extending beyond corporate bounds. In this way, Poduska looks forward to continued growth and recovery for the economy as a whole in the upcoming year. The recent election, he says, provided the "most favorable outlook" for that continuation.

This is not to say that Poduska sees no clouds. He does, and the biggest of those is the deficit. But he adds that "every growth period in our history had some negative factors." What is important to remember about the deficit, says Poduska, is that it can be controlled. "We've got the tools for that," he says.

There will be budget cuts, and he sees these coming in social programs and, a little further down the road, perhaps from defense programs, too. And the cuts will cause problems of their own. "It would be optimistic for us to think that Congress will find the way to cut the budget in the optimum way," he says. Among the negative consequences will be displacement of commerical activity—"when you move money around, you move people around"—and some increase in inflation.

Poduska also warns that U.S. high-technology products can expect even more in the way of competition than they have faced to this point. "There are smart people all over the world," he says. "The world is becoming more entrepreneurially oriented. . . . There are people [such as] venture capitalists in Germany and Japan now. Ten years ago, those words were not understood, much less approved of as a concept. . . . The whole notion of entrepreneurial awards and operations is spreading around the world."

SUTEZO HATA
executive managing director
and group executive,
Electronic Devices Group,
Hitachi Ltd.

The growth in worldwide sales of semiconductors will drop to 20% next year, predicts Hata, down from a breakneck expansion of 50% in 1984. Such a prospect would send most executives to their boardrooms fretting. Not Hata, who is chief operating officer of Hitachi's semiconductor division.

"The drop in sales next year will be tremendous, but in fact, sales are just returning to their normal long-term rate of growth. I don't worry about next year," says Hata.

That is not to say there are no storm clouds on the horizon. The high book-to-bill ratio in the U.S. semiconductor market at present is a "very serious situation," says Hata, and one that could inflame U.S.-Japanese trade relations. "When there is a great gap between demand and supply, all the producers are busy, and there is little trade friction," he says. "But when the gap narrows and a large trade imbalance develops, things heat up."

But this problem is not without its solution. The semiconductor market in the U.S. will stabilize by spring, predicts Hata. This, plus added Japanese production in the U.S. and recent bilateral agreements to do away with all semiconductor tariffs, will help ease the tension.

The Koreans also will prove to be increasingly tough competitors in the semiconductor industry in the next few years, says Hata. But because they began production in a major way only last year and Japan still has a lead of at least several years, claims Hata, the Koreans will not be a major threat for some time.

Jokingly referring to the relationship between U.S. President Reagan and Japanese Prime Minister Yasuhiro Nakasone as the "Yasu-Ron friendship" (first names are seldom used in Japan), Hata is encouraged by the recent re-election of both leaders. The two are pro-business and will encourage strong bilateral ties, which can only have a positive effect on high-tech trade between the U.S. and Japan, he says.

"We very much welcome good relations between the United States and Japan—with America playing the role of older brother and Japan as the younger brother," says Hata.

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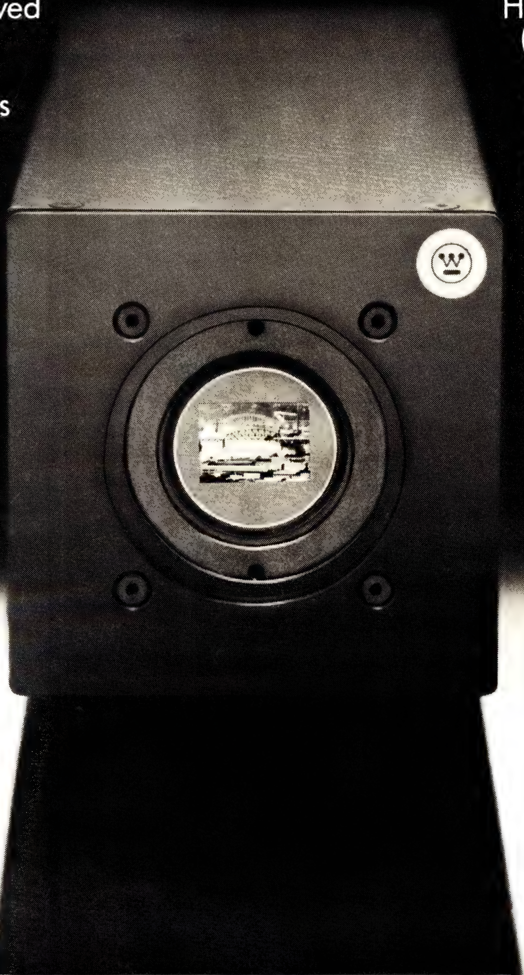

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HOW COPYRIGHT ACT PROTECTS IC MASKS

New act extends copyright-law protection to integrated-circuit masks and the products made from them

☐ *by Philip M. Shaw Jr.*

Semiconductor manufacturers are losing more than $100 million a year to pirates stealing computer-chip designs, according to Tim Richards, an economist at the Semiconductor Industry Association. Further, U.S. chip makers have been reluctant to invest heavily in risky chip designs, knowing that there is no legal recourse against a competitor that reverse-engineers the design and profitably markets the chip.

But the Semiconductor Protection Act of 1984, unanimously passed by Congress and awaiting the President's signature, will change the situation drastically. Under the act, any firm caught copying IC masks and selling products stemming from such masks will face statutory damages. Although legal action cannot be taken against foreign thieves, products of pirated chip designs can be stopped from being marketed in the U.S.

The act defines a semiconductor chip product as a final or intermediate form of any product that has "two or more layers of metallic, insulating, or semiconductor material, deposited or otherwise placed on, or etched away, or otherwise removed from, a piece of semiconductor material in accordance with a predetermined pattern" and that is "intended to perform electronic circuitry functions." Thus, virtually all ICs fall within the definition.

The act also defines a mask work as a "series of related images, however fixed or encoded" that has or represents the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material, present or removed from the layers of the semiconductor chip product. Therefore, a mask can be a photographic negative or a programmed computer tape that carries equivalent information. It is also required that each image in the series hold the pattern of the surface of one form of the semiconductor chip product. A mask work is deemed fixed in the semiconductor chip product when it is such a permanent part of the chip and can be perceived or

Bigger is better. Semiconductor chip manufacturers, such as Honeywell Inc. at its new Colorado Springs fabrication plant, are moving from 4-in. to 6-in. wafers to produce their high-performance, high-density, very large-scale-integration products.

Mask making. Semiconductor manufacturers invest heavily in designing intricate masks for their complex computer chips, only to lose $100 million per year to pirates who steal or reverse-engineer the designs and then market them.

reproduced from the chip over a period of more than transitory duration.

As with a standard copyright, the owner of a mask work is the person who created it or the party to whom all the rights have been assigned. Furthermore, a work that is created as part of a person's job belongs to the employer, and the employer owns the right to register it. For works created by independent contractors, a written assignment will be required to transfer ownership from the contractor to the manufacturer.

Eligibility for protection

After a mask work has been fixed in a chip product, it is eligible for protection under the act if, on the date on which it is registered or first distributed to the public for commercial purposes anywhere in the world, whichever comes first, its owner is either a national or a resident of the U.S. or the mask work is first commercially available in the U.S., regardless of who owns it. There are certain other bases on which the mask work can be registered, such as if the owner is someone who has no citizenship anywhere or is a national or a resident of a sovereign nation that extends similar rights by treaty.

Although there is no contemplated novelty examination to be made at the time of registration, it is clear in the act that protection does not extend to works that are not original or that consist of staple, commonplace, or familiar designs, or variations of such designs. Such a defense of invalidity would be made to the court at the time of an infringement action.

It is clear from the act's legislative history that a court would have to consider whether the mask work as a whole is merely a collection of staple elements—that is, an insubstantial variation of prior work in the field. The test for validity will be a preponderance-of-the-evidence standard, as opposed to the clear-and-convincing-evidence standard used in patent cases. The reason for this is that there is no novelty examination at the time of registration of a mask work, and thus the presumption of validity is not as strong as in the case of a patent.

The act also makes clear that it does not extend protection to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in the mask work. Thus, like a copyright, protection will not extend to the underlying idea embodied in the mask work but only to the actual design.

Ownership of a mask work can be transferred only in writing by the owner or an authorized agent. The assignment or other valid transfer apparently does not need to be notarized but must be filed with the Copyright Office immediately in order to protect the new owner from subsequent transfers by the previous owner. In the case of conflicting transfers, the first transfer will be deemed void if it was not registered with the Copyright Office and the subsequent transfer was made to an innocent purchaser who paid valuable consideration. The first transfer will prevail, however, if it was recorded at least one day before any subsequent transfer and no later than three months after it was executed, the period within which all transfers must be filed.

Protection extends for 10 years from the date on which the mask work is first commercially exploited anywhere in the world or the date on which registration is applied for, whichever occurs first; the period of protection ends on the last calendar day of that year. The owner of a mask work has the exclusive right to do any of the following:

- To reproduce the mask work by optical, electronic or any other means.
- To import or distribute a semiconductor chip product in which the mask work is embodied.
- To license another person to undertake either of above actions.

The exemption of reverse-engineering from infringement liability is likely to cause the greatest amount of litigation. Section 906 of the act defines what is a fair use of the mask work—that is, what can be done without liability for a claim of infringement. It allows reproduction of a mask work solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques

Expensive equipment. Costs are high for chip makers who require sophisticated equipment such as Censor/Perkin-Elmer Corp.'s SRA-100 step-and-repeat system (foreground) and its Micralign 500 mask-alignment system (background).

embodied in the mask work or its circuitry, logic flow, or organization of components. Thus, reverse-engineering is not actionable under the law.

The act goes on to state that a person who has successfully reverse-engineered a mask work is then free to incorporate the results of the reverse-engineering in an original mask made for commercial distribution. Thus it is possible to reverse-engineer a mask work, determine how it is designed, and then redesign it without fear of liability. Only if the mask work is actually copied will there be trouble.

Thus, the test for the court will be whether the allegedly infringing work is a substantial copy or whether it is a new and original work, even if it incorporates the basic innovations of another work.

Protection for the innocent purchaser

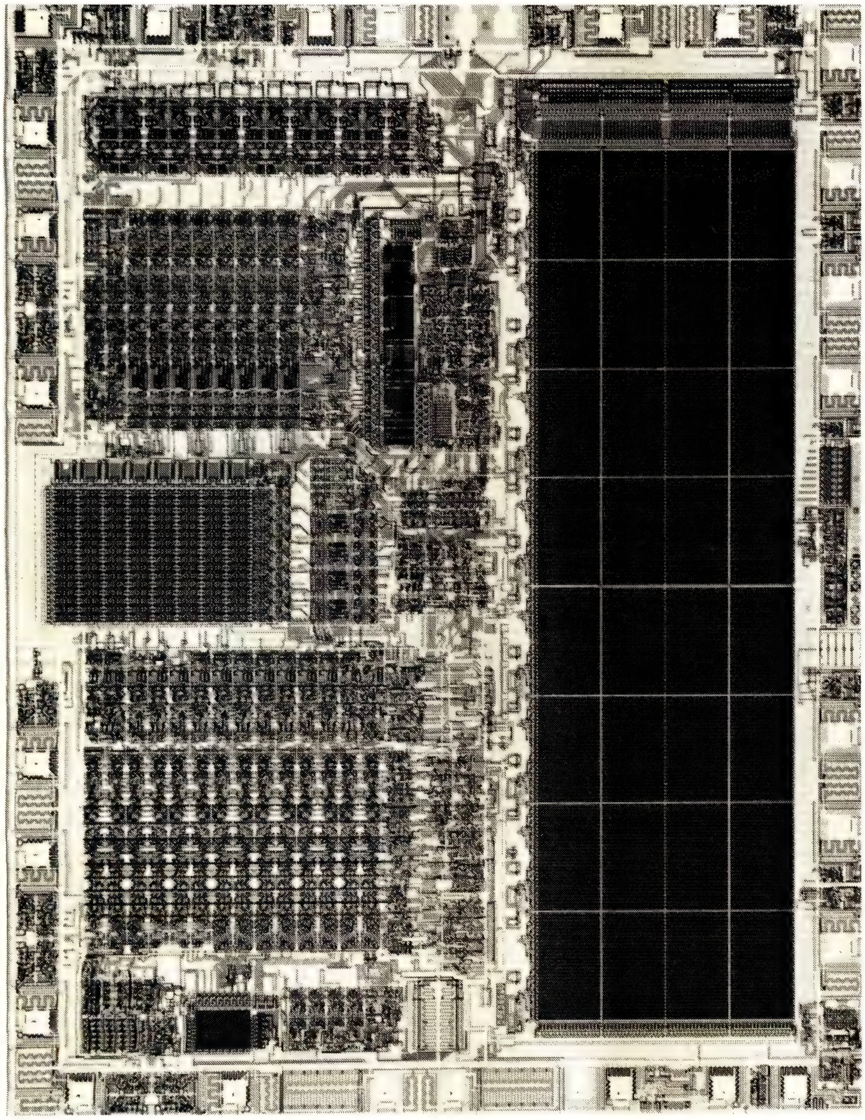
The act also contains a defense for innocent purchasers. An innocent purchaser is not liable should he unknowingly import or distribute an infringing semiconductor chip product. Even after he receives notice that the work is protected, he is liable only for paying a reasonable royalty on the units he purchased before notice and distributed after notice. This defense extends to his customers as well. There is no defense, however, if the purchaser buys the products after notice that they infringe on someone else's copyright.

To secure protection of a mask work, the owner should put a notice on the mask and on the semiconductor chip products embodying it. The notice should be either the words Mask Work, or *M*, or the letter M in a circle, followed by the name of its owner or owners or a recognizable abbreviation. Thereafter, within two years of the date on which the mask work is first commercially exploited anywhere in the world, the owner should apply for registration of the mask work with the Registrar of Copyrights.

The Registrar of Copyrights will set up regulations for filing such applications. One source of concern among the semiconductor industry is what sort of specimens of the mask work will be required to be filed with the Copyright Office. It is possible that the same controversy that involved computer software will again be a problem: a manufacturer will be reluctant to submit a semiconductor chip mask to the Copyright Office for fear that it might be copied or stolen by a potential infringer.

On the other hand, it is absolutely necessary that some portion of the work be recorded in order to identify what mask work was actually registered. Ideally, the Registrar of Copyrights will allow the submission of some identifying portion of the mask work but not require the entire mask work to be recorded. Any existing mask works that were first commercially exploited on or after July 1, 1983, can be registered if protection is claimed not later than July 1, 1985.

The enforcement provisions of the act are quite similar to those provided for any copyright. An owner cannot bring an action for infringement until he has either obtained a certificate of registration or has been refused a registration by the Copyright Office. Registration will be



Talking chip. Manufacturers of clever chip designs, such as this Texas Instruments Inc. speech chip, are frustrated by thieves who steal mask designs and then offer the market similar products at lower cost.

deemed to have been refused if it is not granted within four months of filing of the application for registration. For example, even without a novelty examination, it may be obvious that the mask design is not original. In some emergency situations, the owner can request the court to reduce this waiting period to some lesser term. Should the Copyright Office refuse to register the mask work, the owner can still file for infringement and give simultaneous notice to the Copyright Office.

Burden is on defendant

A registered work is presumed valid and the burden of proving its invalidity is placed on the defendant. Courts are empowered to grant temporary restraining orders, preliminary injunctions, and permanent injunctions at their discretion and can also order the impounding and destruction of infringing works.

The mask owner is entitled to collect actual damages suffered as a result of the infringement, as well as an award of the infringer's profits. The owner is required only to prove the infringer's gross revenue; it is up to the infringer to prove his deductible expenses, along with what portion of his profits did not come from the mask work. Alternatively, the owner of the mask work can decide to settle for statutory damages as set by the court. These can be as much as $250,000 for any one mask work. The court can award full costs, including reasonable attorneys' fees, to the prevailing party. The statute of limitations for bringing an infringement action is three years after the claim accrues.

The other federal laws regarding venue and jurisdiction in the federal courts are also amended to treat a registered mask work just like a registered copyright. Any state laws providing for equivalent rights are preempted as of Jan. 1, 1986. Nonetheless, it is clear in the act's legislative history that before the mask work's first commercial availability or registration, trade-secret law applies. What is interesting, however, is that, apparently, after the semiconductor chip product is first sold commercially, trade-secret law arguably no longer applies to the masks that had been used to make that product, since the state trade-secret law may be preempted.

This will raise an interesting problem for the courts. Take, for example, the situation where a manufacturer's employee makes a copy of his employer's IC masks and then quits to form a startup company that will use those copies to make identical products. If the original employer did not register the mask works after the semiconductor chip products made from those masks have been sold for over two years, it could be argued that they are thereby placed in the public domain, free to be used by anyone. The employee could argue that any contractual provisions or state trade-secret laws could not be used to prevent him from making copies of the mask work because the new act may preempt any state contract or trade-secret provisions that prohibit copying the mask.

Foreign manufacturers of semiconductor chip products might find it in their favor to have the first commercial use of their semiconductor chip products take place in the U.S. to make them eligible for registration under 17 U.S.C. Section 902(a)(1)(B) of the new act. This will become unnecessary if their countries adopt similar laws offering the same sort of protection to U.S. companies or if the U.S. Secretary of Commerce extends protection to their countries in the interim (see 17 U.S.C. Section 902(a)(1)(A)(ii) and 17 U.S.C. Section 914). ☐

Philip M. Shaw Jr. is a partner in the San Francisco law firm of Limbach, Limbach and Sutton.

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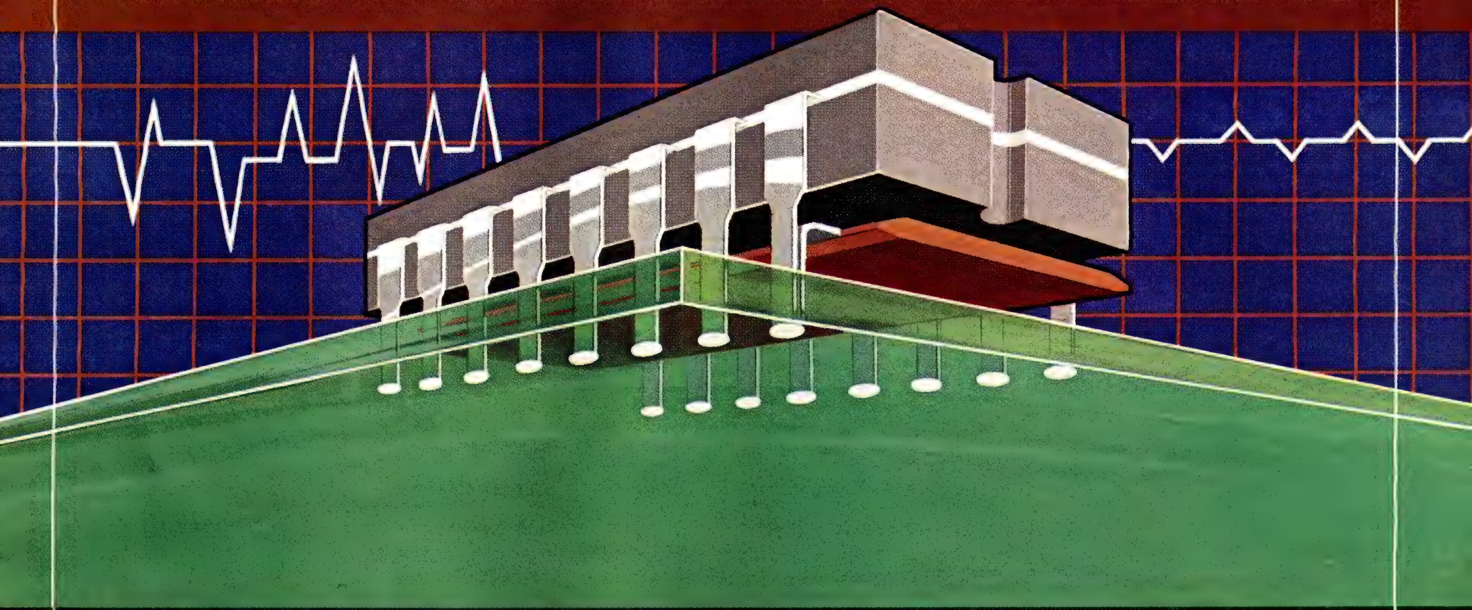

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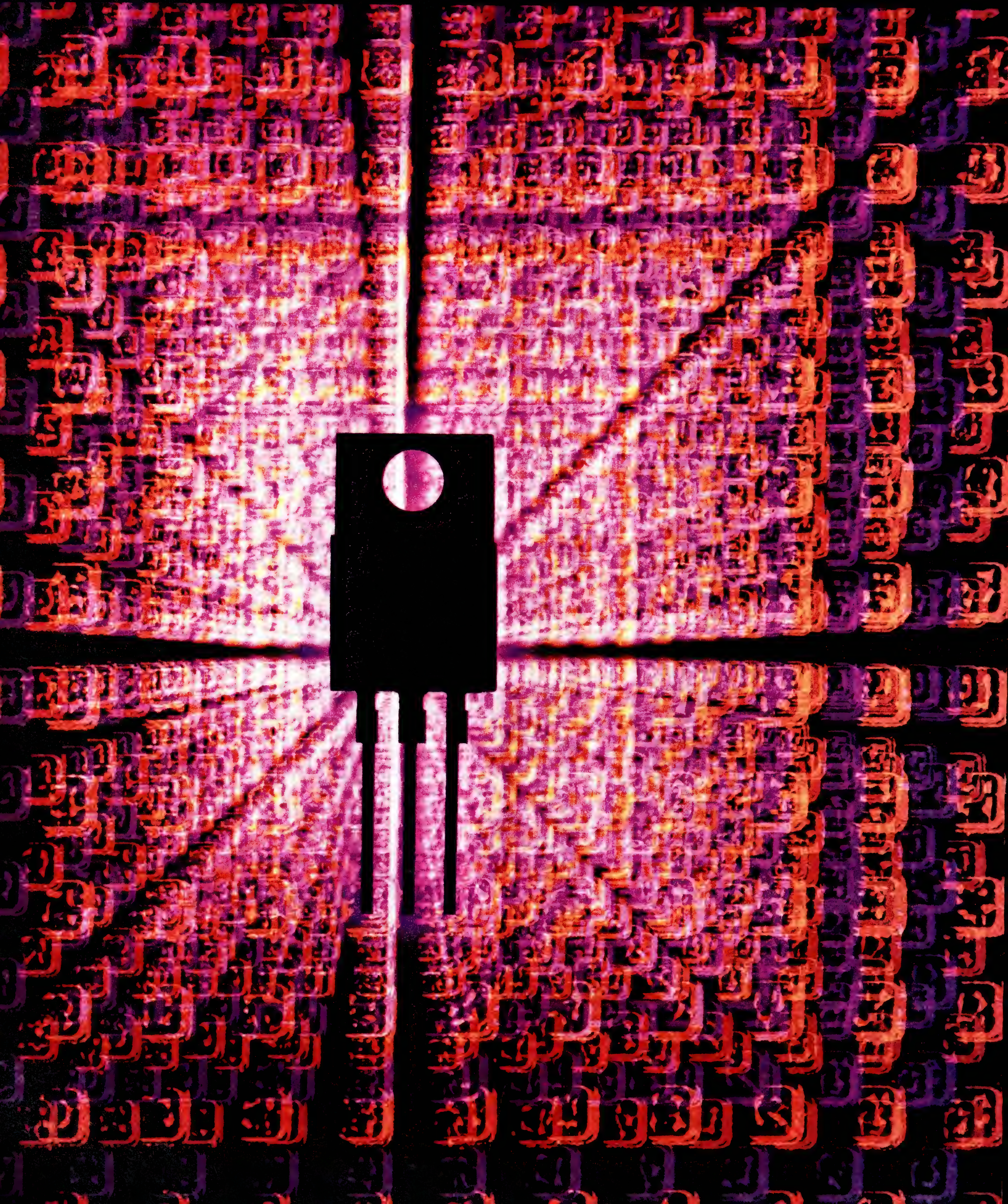

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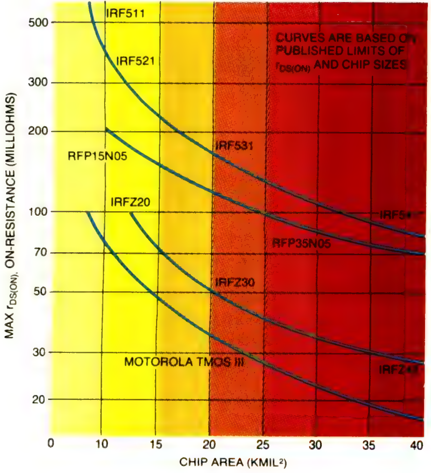

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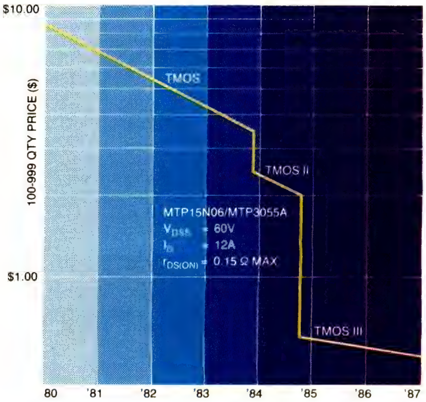

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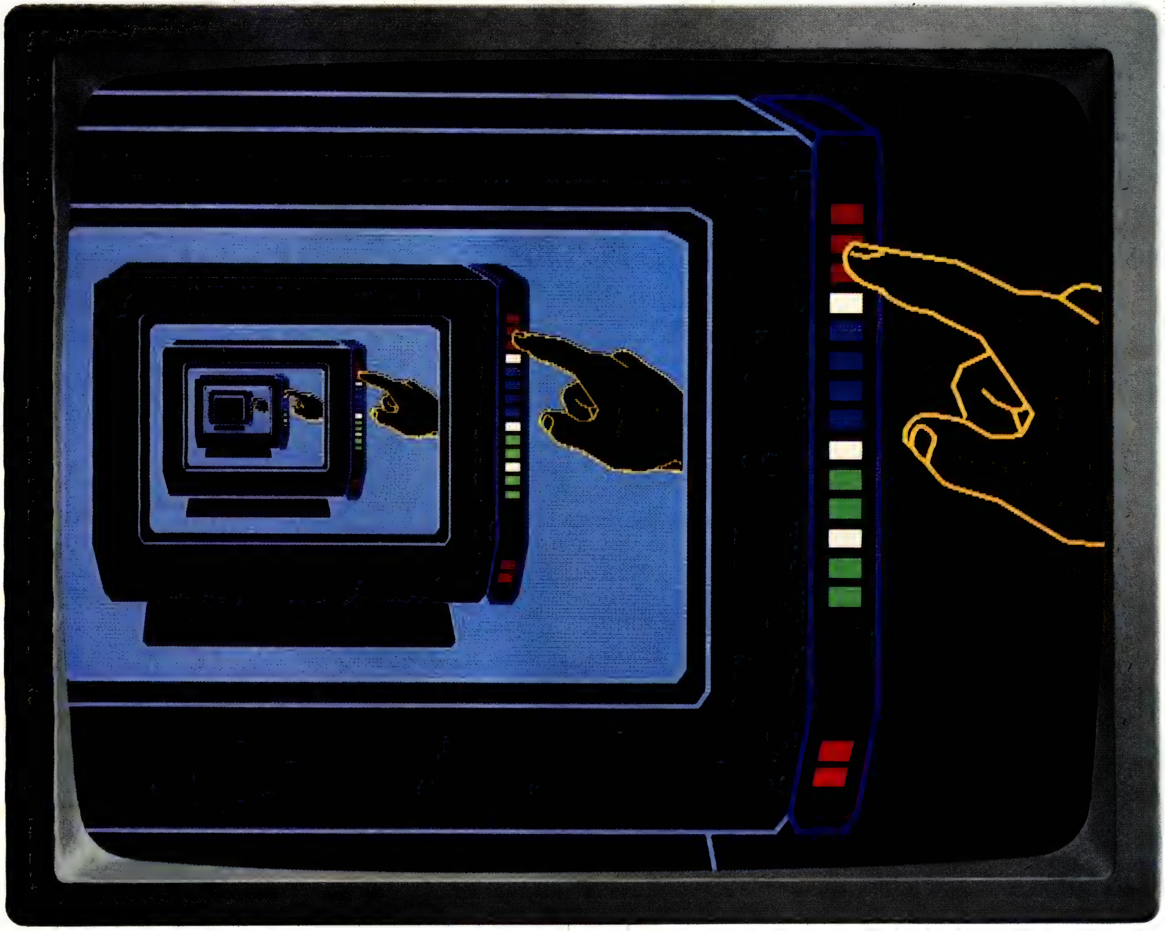

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TWO LOW-SPEED NETS RACE TO LINK COMPUTERS

AT&T's 1-Mb/s and IBM's 2-Mb/s local-area networks are vying for selection by the IEEE as standard for personal computers

☐ *by Robert A. Sehr*

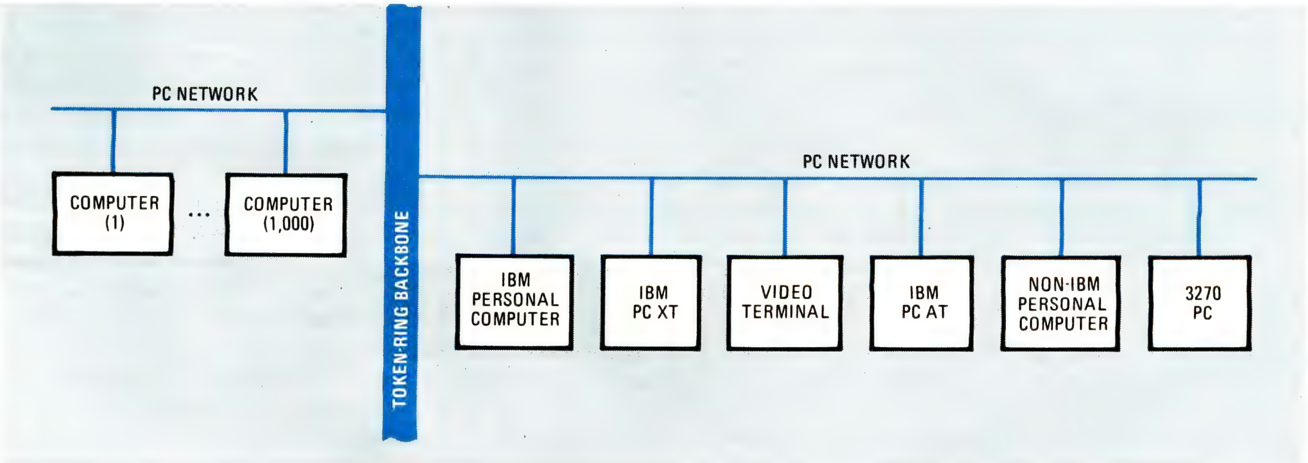
While the love affair between business and the personal computer shows no signs of cooling, users have complained for a long time about the lack of a way to share information. The decline in fortunes of the corporate information center, starting in the early 1970s, coincided with the rise of the personal computer and soon led to the proliferation of data outside a centrally controlled environment.

But there is new hope that what management has torn asunder, technology will reunite. Networking schemes that were too expensive for all but the largest corporations are dropping in price and are thus becoming attractive to the small and medium-size company. As a result, the race is on to promote a new standard for a network that transmits at rates under 10 Mb/s and inexpensively links personal computers while offering the functionality found in such big-ticket networks as Ethernet. This is the goal behind two sharply contrasting proposals for a small-office network standard being pushed by AT&T Information Systems, Morristown, N.J., and IBM Corp., Armonk, N.Y.—both until now sleeping giants in the business of low-cost local networks.

The major difference between an Ethernet-type network and the new generation of low-cost networks is the rate at which data is transmitted. The proposal from the Institute of Electrical and Electronic Engineers' 802.3 committee—which issued its standard for carrier-sensing-multiple-access-with-collision-detection, or Ethernet-like, networks in November—specified a 10-Mb/s transmission rate. PC Net, the network protocol that IBM recently licensed from Sytek Inc., Mountain View, Calif., carries data at a relatively slow 2 Mb/s; AT&T Co.'s proposed StarLan network—which the company admits is not yet a committed product—carries data at only half that speed.

Though such slow speeds would be unacceptable for host-to-host communication, "there is no need for personal computers to communicate at 10 Mb/s," notes Gregory Ennis, director of systems engineering at Sytek. But even though both StarLan and PC Net operate at relatively slow speeds, they are designed and built so they can be bridged to larger networks. These include networks such as Ethernet in the case of baseband StarLan, and IBM's forthcoming token-ring network in the case of PC Net.

The broadband PC Net, which began life as Sytek's



1. Broadband PC Network. A standard 75-Ω coaxial cable forms the data highway for clusters of up to 1,000 IBM Corp. Personal Computers and 3270 PCs. It will also handle voice and video when the backbone token ring becomes available.

Local Net/PC, uses a standard 75-Ω coaxial cable—the same as is used for cable television—so it can transmit not only data, but voice and video signals as well. It supports up to 72 IBM Personal Computers, PCXTs, or PC ATs within a radius of 1,000 ft. of a node. Using a custom-installed broadband network and a $695 PC Net adapter card, up to 1,000 personal computers can be connected within a 3-mile area (Fig. 1).

Seven-layer tree

PC Net is organized into a hierarchical seven-layer tree structure following the plan set out in the International Organization for Standardization's reference model for local-area networks. There is the physical layer, which contains the electronic and mechanical contents of the transmission medium; the link layer, which contains protocol mechanisms; the network layer, which routes packets between LAN channels or installations; the transport layer, which is responsible for end-to-end data transfers; the session layers, which contain user shells; the presentation layer, which manipulates data into presentation form between points in the network; and the applications layer (Fig. 2).

The net services all but the applications layer, which is left to the vendor of the host terminal or IBM PC to customize to a particular application. "The beauty of it is that it allows for an open concept for applications software," Ennis says. "This is the same philosophy that allowed the IBM PC to proliferate as much as it did."

With IBM's strong marketing force behind PC Net, Ennis expects that third-party software writers will rush to create additional multiuser, multitasking applications, ensuring its widespread acceptance. "Up until now, writing a network application program has been kind of risky," says Leo Nikora, a product marketing manager at Microsoft Corp., Bellevue, Wash. "There was no single network standard and no single resource-sharing standard. More important, IBM has indicated that PC Net will be software compatible with its token-ring network, which will further increase the market for application programs, Nikora says.

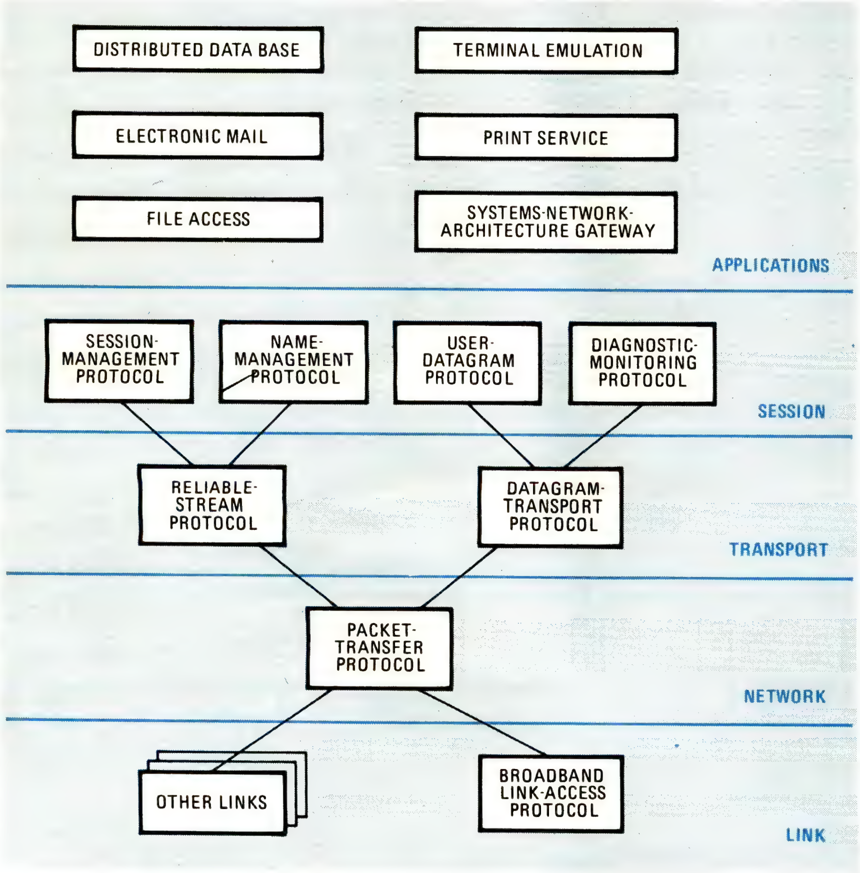
Though some designers question whether Microsoft's MS-DOS and Xenix operating systems can operate at 2 Mb/s, Nikora is sure that PC Net will be able to handle all the traffic that users can throw at it. The reason for this is that actual throughput decreases the further you get from the physical or hardware level: when throughput proves too much for the operating system to handle, it can be buffered outside the operating system under user control.

Below the applications layer are layers of hardware and software welded together to define PC Net's performance. At the network's hub is the PC Net translator, which provides single-channel frequency translation for the network. Up to eight IBM PCs can attach directly to the translator; by using the base expander, a total of 72 IBM PCs can be hung from a single node.

The translator is linked to the IBM PC by up to 200 ft of cable, together with an adapter card that slips into a card slot in the personal computer. At the adapter card's heart is an Intel 82586 controller chip, an 80188 processor, a fixed-frequency modem (which operates at 50.75 MHz for transmission and 219 MHz for receiving), and a Sytek custom chip that complements the 82586 to provide CSMA/CD and modified nonreturn-to-zero (NRZI) data coding.

At the link layer, the link-access protocol provides the CSMA/CD functions that keep users who are seeking the same data on a network from colliding with each other and takes care of error detection. The network level consists of one protocol that is used for packet transfer, which routes packets between separate link-layer channels. Transport-layer protocols follow the ISO Class 4 transport scheme, with the reliable-stream protocol providing a virtual-connection service and the user-datagram protocol providing end-to-end exchanges of packets with a simple best effort.

The session-management protocol—which resides in read-only memory on the network adapter card—builds stream-oriented sessions on top of the reliable-stream proto-



2. Protocol architecture. IBM's PC Network implements a hierarchical seven-layer tree architecture providing full network functions up to the applications layer. It is up to the systems integrator to design the applications-layer functions.

col's virtual connections, allowing session participants to be identified by symbolic names. Users can register these symbolic names by means of the name-management protocol in the same layer. Also located in the session layer are the user datagram protocols, which allow users to send datagrams with symbolic names rather than with network addresses, together with the diagnostic and monitoring protocol, which gives the network's statistics and status.

In contrast to the complex structure of PC Net, StarLan's heart is a simple 1-m bus that connects to each personal computer by means of twisted-pair wiring dropped from a building's standard telephone-wiring closet, where the bus is centered (Fig. 3). The twisted pairs terminate in RS-422 line drivers and receivers in the closet. Each hub supports up to 50 users connected within 600 to 800 ft of the wiring closet.

Telephone-wire tie-in

In pushing the StarLan proposal before the IEEE 802.3 committee, AT&T noted that most office buildings have a standard telephone connection with 25 twisted pairs, of which only a few are used. As a result, it won't be necessary to rewire existing buildings—or prewire new ones—as is required for Ethernet, its RG-58A/U variant (dubbed Cheapernet), and token-ring networks.

This feature is a major selling point for StarLan. Because it uses commonly available phone wire, which is present in every office building, facilities already exist to tie several hubs together (Fig. 4). Thus, StarLan can be bridged to faster transmission backbone networks, such as Ethernet or Cheapernet.

The worst-case estimate, according to one of the task forces chartered by the IEEE 802.3 committee, puts StarLan's cost at about $200 per connection, including the network processor, wiring, installation, and repeaters or hubs. Some estimates put the cost as low as $50 per connection, plus installation. In addition, "moving a computer in the network will be as easy as moving a telephone," says Timothy A. Rock, a member of the technical staff at AT&T Information Systems Laboratories, Holmdel, N.J. "It will actually be easier, since lines in the StarLan network are individually unique."

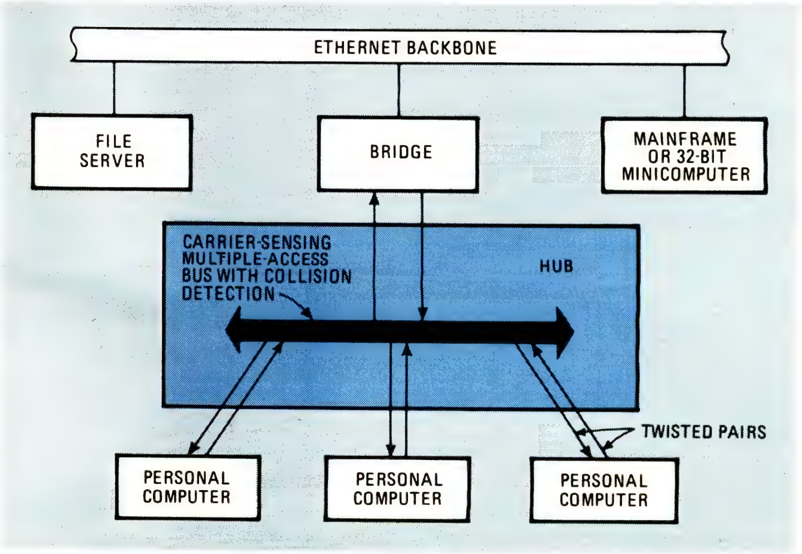
Regardless of AT&T's claims for StarLan, so many doubts surfaced over the capability of twisted pairs that the IEEE 802.3 committee, meeting in Vancouver, B.C., Canada, in July, formed a task force to study the matter further, and it reported back at the October meeting in San Diego. Among the subjects studied were the effects of distance from the wiring closet and the reliability of old wiring in existing buildings compared with new twisted-pair wiring. Committee chairman Donald Loughry, of Hewlett-Packard Co., Cupertino, Calif., says that twisted pairs can accept transmissions at the 1-Mb/s transmission rate. He adds, however, that it is "something that merits further testing by an independent agency."

In addition, others have raised questions about the advisability of running 1-Mb/s transmissions through twisted pairs. Sytek's Ennis, for one, is skeptical. "I wonder if running that kind of transmission through unshielded twisted pairs meets the Federal Communications Commission's noise requirements," he says. T. A. Rock, however, says almost every test AT&T has run on StarLan demonstrates that it can run safely at 1 Mb/s in existing wiring in most office buildings. (Ironically, one of the few buildings that was unable to pass the test was AT&T's own headquarters.)

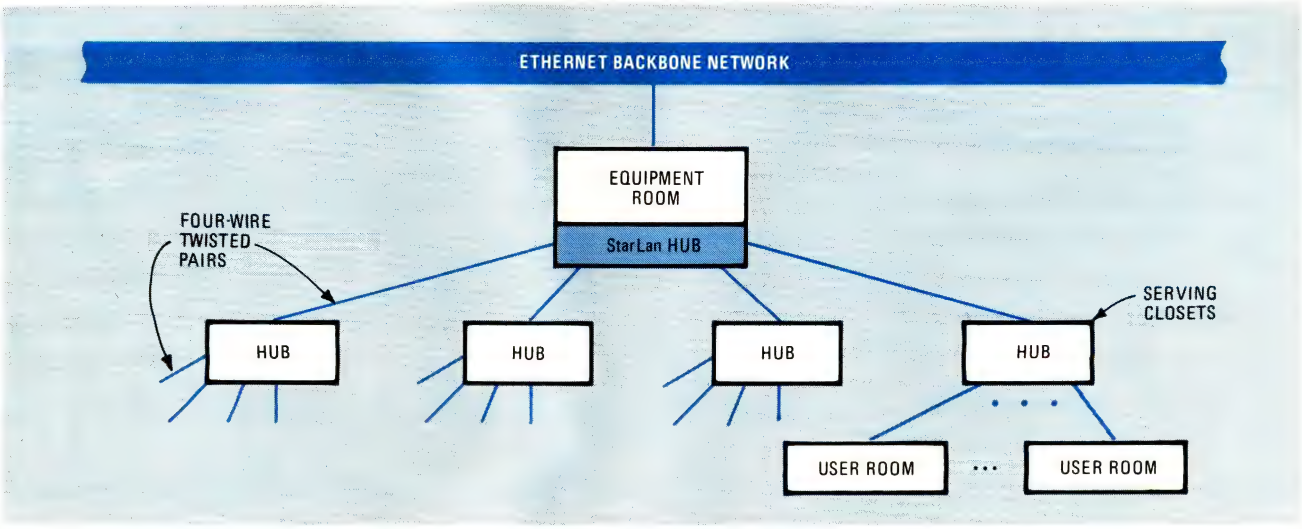
The cost of wiring buildings is a significant factor in the acceptance of LANs, and most observers agree that the high cost of the heavy-duty yellow Ethernet cable—as high as $4 per ft—has prevented Ethernet from becoming popular in small and medium-size offices. As a result, alternative networking schemes using twisted pairs have been developed—for example, Omninet, spawned by Corvus Systems Inc., San Jose, Calif. Omninet, however, does not use collision detection to determine which station gains access to the network. StarLan can detect a collision on the bus; since the bus in the wiring closet is so short that it does not allow the signal to weaken, it enables collision detection to be achieved through logic rather than through the Ethernet-type transceivers that look for voltage shifts.

New logic

Further interest in StarLan focuses on the new generation of logic being evaluated for use in the network. The controller will be the successor to Intel Corp.'s 82586, the chip that has been the center of most networking schemes. Designed for networks with data rates under 2 Mb/s, the new chip will be released in the fourth quarter, although the company has already sent samples to what it calls "users with systems savvy." Intel, however, has provided only sketchy details about the new chip—other than to say it will combine the functions that now require two separate chips, as well as add functions that



3. Closeted bus. A 1-m bus in a building's telephone-wire closet forms the heart of AT&T Information Systems' StarLan. The system uses twisted-wire pairs that hang off the bus to make the attachment to personal computers and link them in the network.

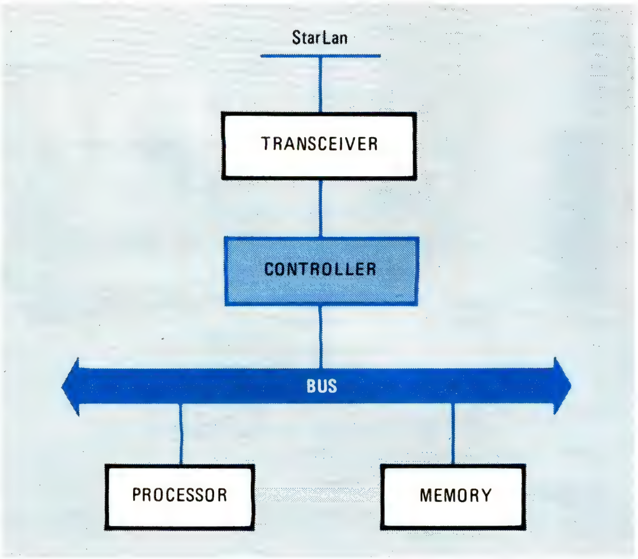


4. Cheap wiring. Proponents of StarLan claim that its use of the ubiquitous four-wire twisted pairs—as found in standard telephone wiring—will contribute dramatically to the drop in wiring prices of local-area networks.

have never before been present. "We've provided 90% of StarLan on our new chip," says Robert Galin, Intel's director of strategic planning.

The new Intel chip at the center of StarLan provides collision detection at the chip level, using an exponential algorithm to reset transmission time after each detection of a collision. In other words, when two users attempt to access the same data simultaneously, the user who is detected first is allowed to proceed; a busy signal is sent back to the other user or users while the system automatically tries again after a measured period of time that increases after each attempt (Fig. 5).

The Intel chip looks for a phase shift in the Manchester coding, through which baseband networks such as Ethernet recognize signals. Manchester coding splits each bit into a signal and its complement, so that there is always a zero crossing at the middle of the time slot—or each bit sent. A collision will cause this crossing point to move outside its time window. The limitation on such a system is jitter in the signal. According to AT&T, StarLan can tolerate 50 ns of timing jitter.



5. New controller. AT&T Information Systems' StarLan is being evaluated with a new-generation controller that detects collisions and performs retries using internal logic. Bus length in the wire closet is kept short, enabling the logic to sense a collision.

Intel's chip also will provide data coding in the narrower NRZI coding scheme used by broadband networks, which must be more cautious of bandwidth. As a result, the new chip will not only benefit StarLan but could also be used in IBM's PC Net. "We have tried to make the chip as versatile as possible. While our competitors were trying to decide between broadband and baseband, we wanted something that would optimize the environment," says Galin.

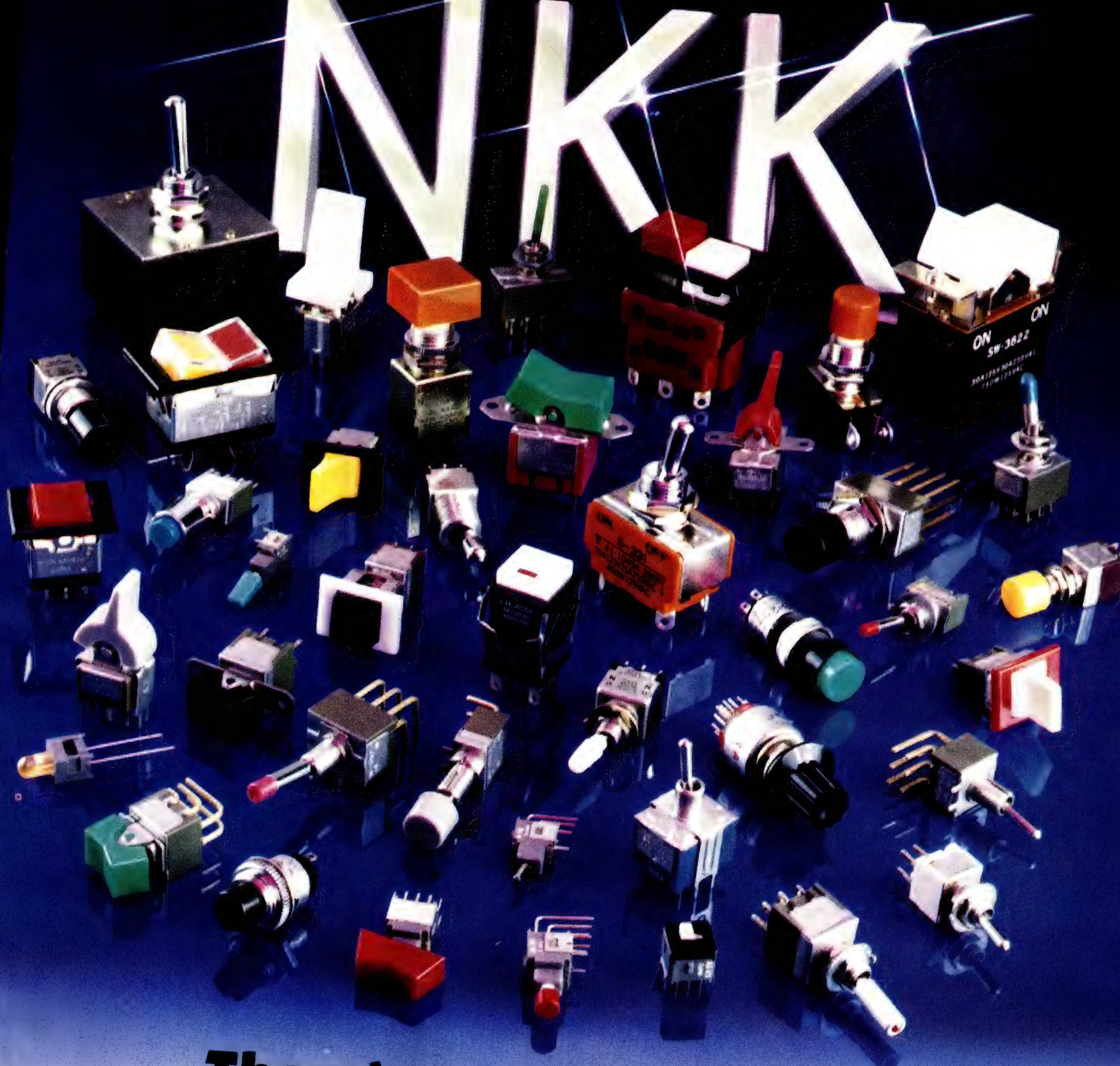
The new chip reduces cost not only through its reduced size—which means it needs less silicon—but also by taking out such devices as the direct-memory-access controller. The DMA controller restricts the kind of applications that the chip can run, Galin says. Instead, the new chip will depend on systems integrators in order to perform DMA functions.

Sytek's Ennis says the new chip will be a part of PC Net as soon as it becomes available. He applauds Intel's flexibility, believing it showed more foresight than the firm's competitors, which are making more restrictive networking chips primarily for Ethernet and Cheapernet.

Galin says Intel saw a need for a network that could transmit at under 2 Mb/s without being bogged down in specifics. THe firm hedged its bets on various proposals for low-cost networks by contributing to all of them. Intel worked with Sytek before the IEEE 802.3 committee and also initiated the task force that began work on another 1-Mb/s LAN based on coaxial cable—the mid-range LAN, proposed by NCR Corp., San Diego. That task force decided that it should concentrate on a single standard proposal and picked StarLan.

"There really should be more than one," Galin says. "There are some users who will need the voice, video, and data transmissions found in PC Net and will be willing to pay the higher cost. Others won't need it and will settle on StarLan." ☐

Robert A. Sehr is a consultant and writer on network transmission systems.



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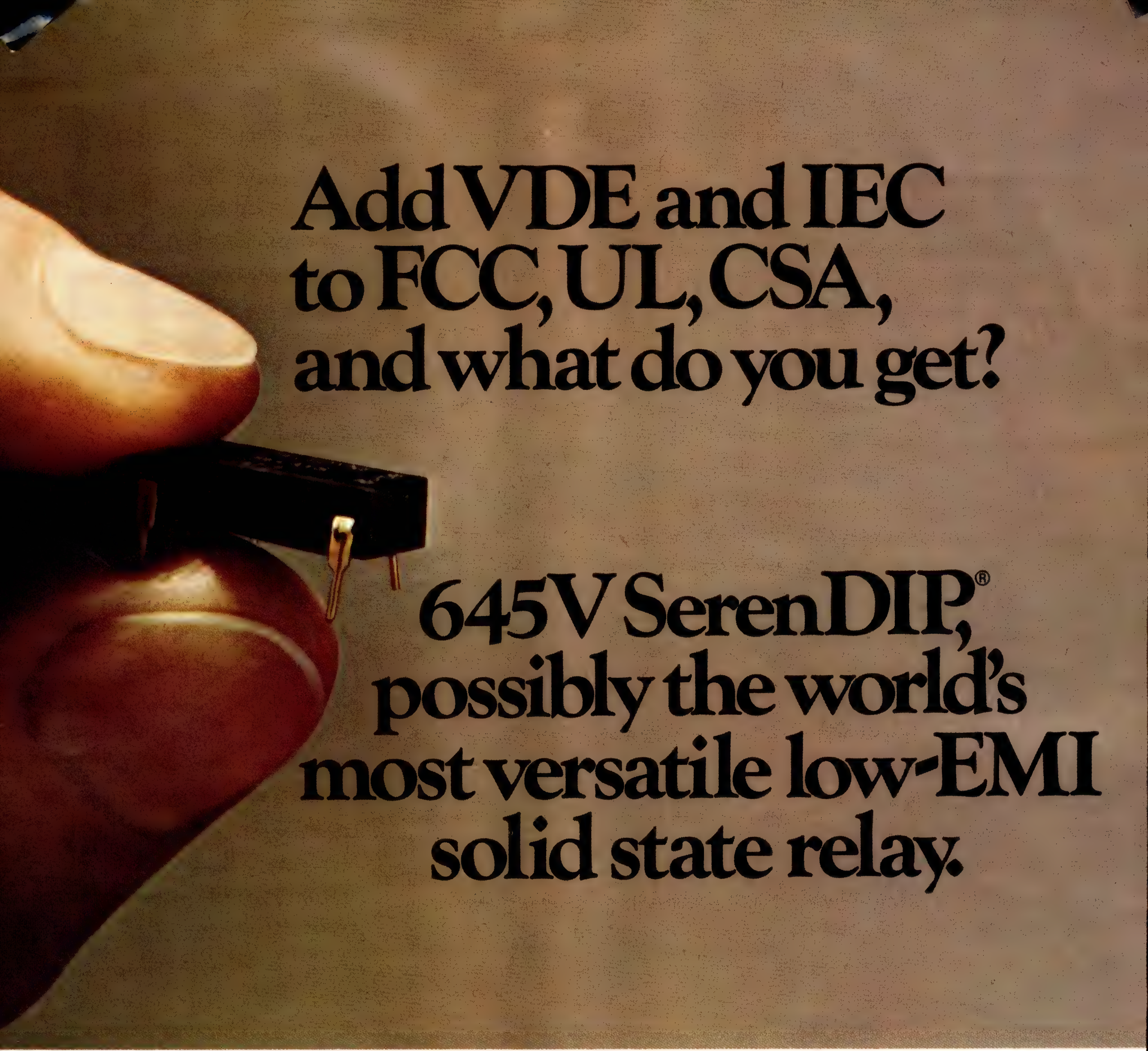
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UNIQUE NET LINKS MACs WITH IBM PCs

Network's distributed-file-server concept offers direct file communications among similar machines and operating systems

☐ *by Steve Zollo*

Together at last is an apt way of describing the Transcendental Networking System, which can link computers of different makes and operating systems, such as IBM Corp.'s Personal Computer with Apple Inc.'s Macintosh, as well as Unix- and CP/M-based microcomputers. The networking system, known as Tops, will let users buy computers to take advantage of their unique characteristics without having to worry if the machines will fit in with their other equipment.

According to Michael Pflaumer, vice president of Centram Systems West Inc., each machine on the network can be accessed at any time. A Tops user may treat a remote file—created under any operating system—exactly as if it were resident on his or her own external disk drive. Application programs are simply unaware of where the file comes from or in what format it was originally created. Remote directories appear as if they were local, with no noticeable loss of performance. All network functions take place in the background, without disrupting other users.

Tops uses a distributed-file-server technique; this means that the disk and other peripheral resources of each computer on the network may be assigned a network name. In principle, every disk drive, both hard and floppy, may be accessed remotely. However, full security is provided to protect against unauthorized access.

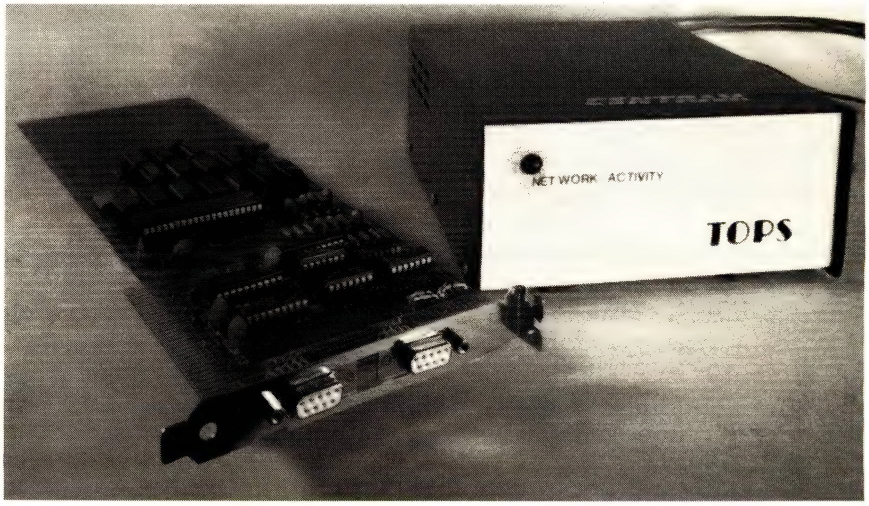
Many other networks use a central disk-server technique, in which each station relies upon a single piece of fallible equipment for network functions. When there is a failure in that piece of equipment, all network activity ceases. With Tops, a failure in one machine on the network has no effect on the other machines.

Also, with a central disk server, no real-time communication can take place between users on the network and data-base files cannot be accessed by more than one user at a time. For users of different operating systems to access a file, they must first run a utility program to convert and copy the file to their own operating system's format and server partition.

Tops is both a hardware and software product. The hardware consists of an add-on card for PC-compatible computers and other machines with expansion slots. Other computers are networked with an external network unit. Machines are connected over a low-cost, four-conductor telephone cable that provides a physical link operating at up to 0.8 Mb/s.

The software provides the standard ISO network layers and the Tops interoperating-system translation facility. Tops solves the problem of machine compatibility by translating the requests of each supported operating system into generic requests recognized by the Tops software on remote target machines. For example, with Tops, a user can store files from a Macintosh on the hard disk of an IBM PC/XT, use an 8-bit CP/M-based computer to access a Word Star file created by and stored in a 16-bit MS-DOS computer, or print text using a printer attached to a remote Unix-based computer.

Tops software acts as a standardized environment, supporting generic operating-system calls. The translation software resides logically just above the transport subsys-



tem of the network, with operating-system-specific links upward to the local machine and standardized downward links to the transport subsystem. The Tops protocol allows up to 254 station addresses per network, and over 65,000 networks can be linked together.

The machines initially supported by Tops include the IBM PC, including the XT, AT, and IBM compatibles; CP/M-based machines from Epson, Morrow, and others; Apple's Macintosh and Lisa; Tandy Corp.'s TRS-4, 12, 16, 1200, and 2000; 68000-based microcomputers under Unix; and minicomputers running Unix. Tops will be available for PC-DOS, MS-DOS, and Macintosh DOS by March of 1985 and for CP/M, Unix, and other operating systems by the summer of next year. Prototypes will be available in February.

Systems integrators using Tops will be able to offer their customers networking at about $100 less per connection than today's average per-connection costs.

Centram Systems West Inc., 2372 Ellsworth Ave., Berkeley, Calif. 94704. Phone (415) 644-8244 [Circle reader service number 338]

Single-height Eurocard holds J-11 CPU

Built around the 16-bit J-11 central processing unit, the GESMPU-11 microcomputer board fits the 100-by-160-mm single-height Eurocard and is compatible with the standard nonmultiplexed 16-bit G-64 bus. The board has a memory-management unit for an extended addressing range of up to 512-K bytes, and it also contains a triple 16-bit timer, a priority-interrupt controller that supervises up to 10 interrupts, and a programmable serial RS-232-C interface with programmable baud rate.

The GESMPU-11 allows owners of a PDP-11 software base to keep their investment and to take advantage of the Eurocard/DIN 4162 connector form factor, while saving on hardware costs. The RSX-11 operating system as well as Micropower Pascal will be offered in the first quarter of 1985.

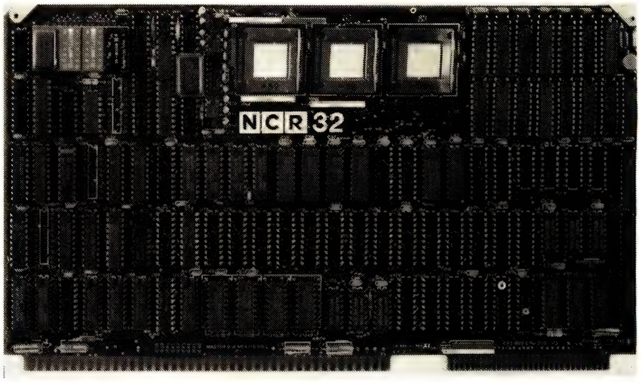
Available now for immediate delivery, the GESMPU-11 central processing unit sells for $1,750 each.

Gespac Inc., 550 E. Grandview St., Mesa, Ariz. 85203.
Phone (602) 962-5559 [Circle 341]

32-bit microprocessor works on a Multibus board

Consisting of a microprogrammable central-processor chip, an address-translation chip for memory management, and an extended-arithmetic chip to provide floating-point math capabilities, the NCR/32-796A is a full 32-bit very large-scale integrated-circuit set. Possible applications for the Multibus board include dedicated algorithmic processing, graphics coprocessing, robotics control, high-level-language acceleration, and virtual-machine emulation.

Features of the board include a 32-bit arithmetic-logic-unit bus and a 32-bit processor-memory bus, as well as dual-port main-memory access by way of Multibus or iLBX. Operating with a 13.3-MHz clock, the board has instruction and bus access times of 150 ns. The available addressing range is 4 gigabytes of virtual memory and 16 megabytes of real memory.



Proprietary software on the board provides a debug monitor as well as trap-and-interrupt service routines. Using the NCR/32-796A in a development system requires a computer that is compatible with an IBM Corp. Personal Computer and a Multibus chassis, adapter kit, and memory board. The NCR/32-796A board costs $4,995; software, $895. Both are available now.

NCR Microelectronics Division, VLSI Product Marketing, 1635 Aeroplaza Dr., Colorado Springs, Colo. 80916.
Phone (800) 525-2252 (in Colorado, [303] 596-5612) [Circle 340]

Multibus board supports Unix, other systems

Running at 8 or 10 MHz, with drivers for Ethernet, Synchronous and Higher Data Link Control protocols, and floating-point processors, the HK68 supports Unix systems III and V, as well as CP/M-68K, Polyforth, Regulas, and VRTX operating systems.

Both the 10-MHz and the 8-MHz boards feature a 68000-68010 central processing unit, up to 1 megabyte of dual-access random-access memory with parity, and up to 64-K bytes of erasable programmable read-only memory. Four RS-232-C ports are available, with RS-422 optional on one port, and two iSBX connectors offer the possibility of further input/output expansion.

The HK68 can be purchased unbundled or included in Minibox, the manufacturer's Unix development system, or with other rack-system components.

The board is priced at $4,495. Delivery time is 30 days.

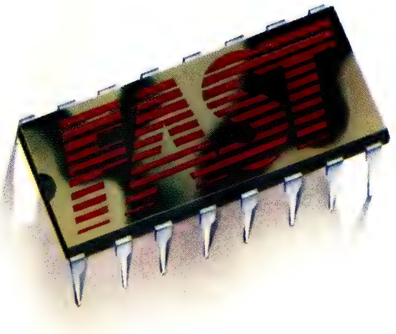
Heurikon Corp., 3201 Latham Dr., Madison, Wis. 53713.
Phone (800) 356-9602 (in Wisconsin, [608] 271-8700) [Circle 342]

Linear array's component placement makes wiring easy

A unique linear array has been introduced by Micro Linear Corp., a semicustom and custom integrated-circuit maker. The array's circuit components are arranged on a chip in blocks that can be wired into functional elements by a final metalization process.

The circuits, called linear mosaic arrays, are analogous

CLASSIFIED 1-A.



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Circle 117 on reader service card

The difference between Series III is a matter

Bendix® MIL-C-38999 Series III connectors are tested tougher over a wider temperature range.
Because Bendix connectors were the first to meet Series III test standards, (as well as I and II) we fully understand the differences between Series III and other MIL-C-38999 test requirements.

You should, too. Highly reliable performance under extremely adverse conditions is what you pay for in a circular environmental connector. So it makes sense that your best choice for critical applications within MIL-C-38999 is the connector that undergoes the most stringent testing.

Sine Vibration
Series III connectors undergo 60 G's for 36 hours with a temperature cycle from −55°C to 200°C. Series I & IV connectors only withstand 30 G's for 12 hours at ambient temperature. Series II are not tested for sine vibration.

Random Vibration
Series III connectors undergo 44.1 GRMS at maximum rated temperature, 200°C (Class F & K). All other series receive the same test but at ambient temperature.

Humidity
Immediately following a 1000 hour temperature life test (200°C for Class F & K, 175°C for Class W) Series III connectors are placed in a 10-day cyclic humidity chamber and tested for insulation resistance and dielectric withstanding voltage. No other series connectors receive temperature life prior to the humidity test.

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and other 38999 connectors
# of degrees.

External Bending Moment
While Series III connectors must undergo a torque test of 1,000 in./lbs., Series I & IV connectors only receive 650 in./lbs. (Series II 150 in./lbs.)

Selecting Series III connectors over other MIL-C-38999 connectors is a logical choice when you compare test requirements. Choosing Bendix Series III connectors is easy when you consider our experience, quality, distribution and broad product line. We can meet your needs for filtered, fiber optic, hermetic, firewall, thermocouple and lanyard release models.

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EUROPE: Austria—Vienna, (0222) 925166, Telex: 132661
• **England**—Whitstable, (0227) 264411, Telex: 96157
• **France**—Paris, (01) 5888682, Telex: 360264
• **W. Germany**—Heilbronn, (07131) 4861, Telex: 728816
• **Italy**—Arese, (02) 9385161, Telex: 334899
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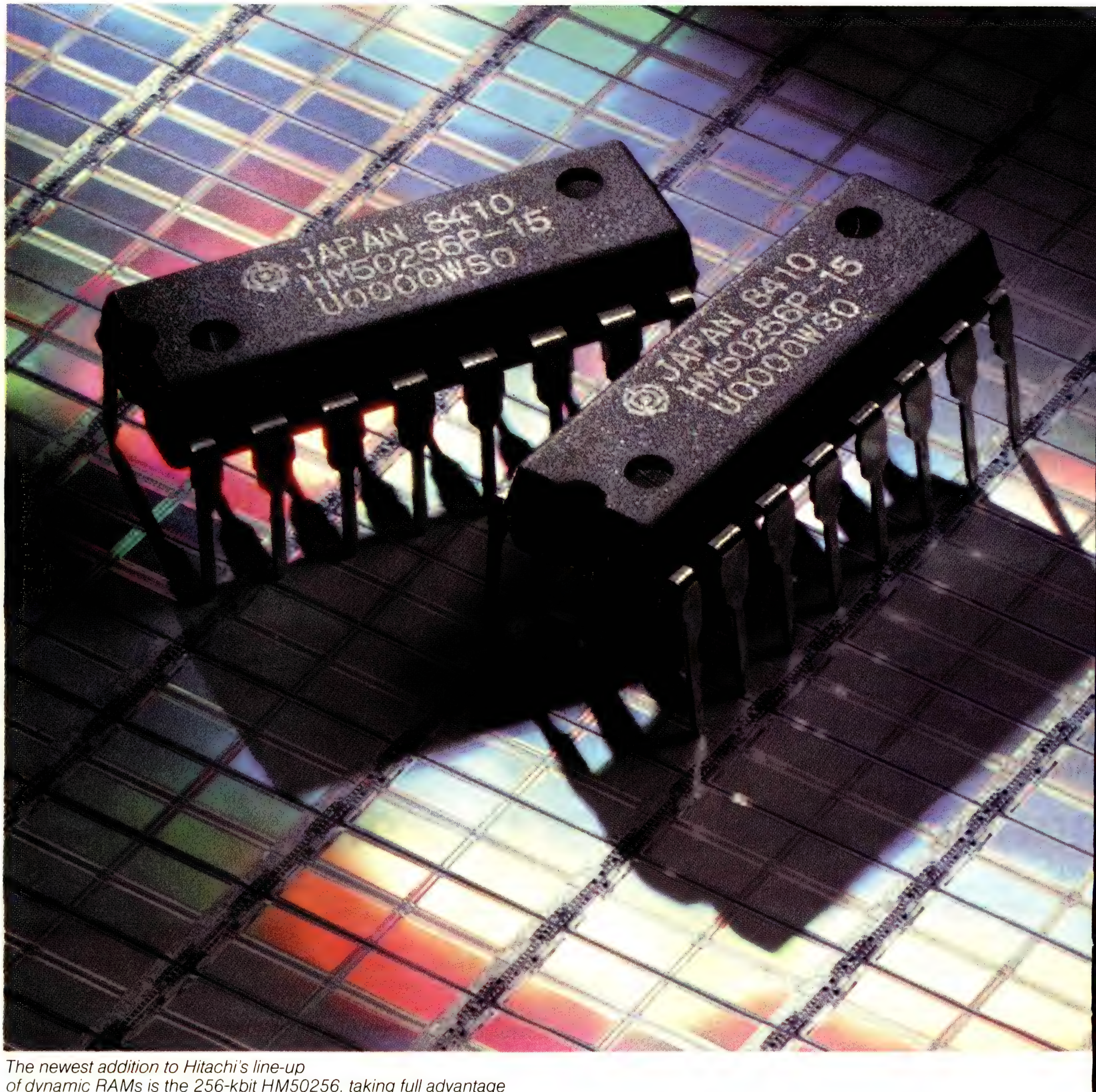
Circle 118 on reader service card



The newest addition to Hitachi's line-up of dynamic RAMs is the 256-kbit HM50256, taking full advantage of Hitachi's own 2-micron process technology.

THANKS TO HITACHI'S ADVANCED R&D
AND PRODUCTION CAPABILITIES,
THE HIGH-PERFORMANCE DRAMS YOU NEED ARE

READY

At the leading edge of the semiconductor field, a variety of dynamic RAMs are offered by Hitachi, a name renowned throughout the industry for quality, reliability and availability. Here are the sought-after products and dependability you demand, based on fine-pattern process technology and circuit design expertise second to none.

ith up to 256 kbits

The HM50256 features a 262,144 word × 1 bit configuration. In addition to conventional high-speed page-mode operation, with access times of 120, 150 or 200 ns, it provides memory refresh in three modes: $\overline{\text{RAS}}$ only, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$, and hidden refresh. A nibble-mode type, the HM50257, is also available for 4-bit serial read/write applications. Both types come in a standard 16-pin DIP for drop-in compatibility with popular 64K DRAMs.

In fact, compatibility is a key consideration in Hitachi's development of new DRAMs. As the trend shifts toward larger, faster, more powerful memories, Hitachi assures DRAM users of continuity of design and performance specifications—a point that's been proven again and again as Hitachi has moved up the scale from its first 1-kbit DRAM to today's 256-kbit units.

The newest products are the results of Hitachi's own 2-micron process, which packs more memory into highly dependable devices. That means exceptional power and compactness in office systems, portable electronic devices, and every application where speed and performance are crucial.

With extensive R&D

Just introduced were the HM50464P and the HM50465P 18-pin 256K DRAMs organized with 64 kword × 4 bit in page mode and nibble mode, respectively. What's more, Hitachi engineers are working on plastic leaded chip carriers (PLCCs) to further reduce unit size.

Such innovations as these are possible because of Hitachi's ongoing commitment to research and development activities, involving the talents of some 16,000 researchers in electronics and other fields. So when you're ready for the best in DRAM technology, deal with a leader. Contact Hitachi.

HITACHI

For more information:
Hitachi, Ltd., Semiconductor & IC Div., New Marunouchi Bldg., 5-1 Marunouchi 1 chome, Chiyoda-ku, Tokyo 100, Japan Tel: Tokyo (03) 212-1111
Hitachi Electronic Components Europe GmbH, Hans-Pinsel-Strasse, 10A, D-8013 Haar/Munich, W. Germany Tel: 089-46140
Hitachi Electronic Components (U.K.) Ltd., HITEC House, 221-225 Station Road, Harrow, Middlesex, HA1 2XL, United Kingdom Tel: 01-861-1414
Hitachi Electronic Components (Asia) Ltd., Unit 512-513, World Finance Centre-Harbour City, North Tower Canton Road, Tsim Sha Tsui, Kowloon, Hong Kong Tel: 3-7219218
Hitachi America, Ltd., Semiconductor & IC Sales & Service Div., 2210 O'Tool Avenue, San Jose, CA 95131, Tel: 408-942-1500

Circle 120 on reader service card

to digital gate arrays. However, the FB300 series circuits contain not gates but analog components, grouped in "tiles." Each tile has 32 transistors (both npn and pnp), 102 resistors, and a capacitor. Designers can wire them up by using macrocells from Micro Linear's library, which determine connections and outputs.

Linear arrays have been available for some years, but Micro Linear claims to be the first to arrange them in tiles, which make it easier to place the macrocells. The tiles were designed to mesh with the macrocell library. There are now 24 macrocells available, including output buffers, operational amplifiers, video amplifiers, comparators, and timers. The value of the capacitor is adjustable from 0 to 10 pF during metalization.

Micro Linear claims the technique makes possible a four- to sixfold reduction in the number of packages in a system over designs made from standard chips. Dual-layer metal makes complex connections easier. Most important, says the firm, is that it allows the linear-systems designer to create semicustom ICs without being an expert in IC design.

Because the wafers can be inventoried until the final metalization is determined, Micro Linear says it can deliver semicustom chips in six weeks. The company offers a linear computer-aided-design package, Linear CAD 1, that runs on an IBM Corp. Personal Computer. Its features includes schematic capture and Spice circuit simulation.

Micro Linear Corp., 2092 Concourse Dr., San Jose, Calif. 95131. Phone (408) 262-5200 [Circle 387]

Synthesizer's signals are accurate to within 1 kHz

A five-digit synthesizer that employs a single phase-locked loop, the SI-160 provides emitter-coupled-logic signals into a 50-Ω load over the range of 20 to 160 MHz with a resolution of 1 kHz. Temperature stability is guaranteed to ±1 ppm over the temperature range of 0°C to 50°C. According to the company, typical applications include plotting and alignment of active and passive filters, calibrating standard analog oscillators, and providing a low-phase noise source for microwave oscillator stabilization.

Options include external binary-coded-decimal programming with latching for computer control, sine-wave output at 13 dBm into 50-Ω load, and a standard 19-in. rack-mounting adapter. Custom configurations can also be provided. The SI-160 is powered by either 115 or 230 V ac, and 50 or 60 Hz at 8 W.

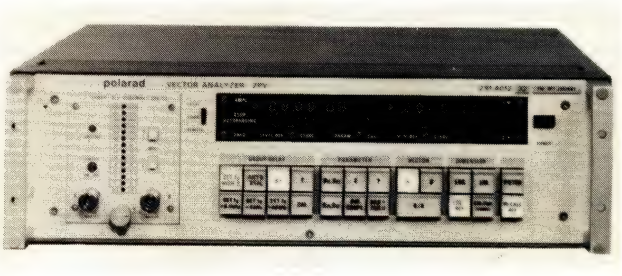
The SI-160 frequency synthesizer is available from stock to 30 days; its price is $800.

Syntest, 40 Locke Dr., Marlboro, Mass. 01752. Phone (617) 481-7827 [Circle 344]

Vector analyzer becomes programmable on IEEE bus

Three modular plug-in tuners give the model ZPV vector analyzer a frequency coverage from 10 Hz to 2 GHz for applications in production and quality control, and crystal, antenna, and amplifier measurements. The basic unit consists of a dual-channel vector voltmeter and a microprocessor-controlled analyzer section. With the IEEE-488 bus option, the model ZPV-B1, it is possible to measure phase in addition to voltage, and the analyzer becomes fully programmable.

The following are programmable on the ZPV: learn mode, status byte and error messages, high-speed trigger, internal and external mode, and different delineators or addresses. The ZPV may be programmed by means of software packages without resorting to IEEE commands.



The built-in microprocessor delivers automatic range selection, permitting direct reading of the measured parameter, and also monitors the control voltage. The ZPV is capable of driving a common X-Y recorder.

The the ZPV sells for $11,700. Depending on the range the modular tuners go for $4,275 (the model E1), $5,775 (E2), or $4,895 (E3). Delivery is promised in from 90 to 120 days.

Polarad Electronics Inc., 5 Delaware Dr., Lake Success, N.Y. 11042. Phone (516) 328-1100 [Circle 343]

Seven optical power sensors are interchangeable on meter

A digital optical power meter with two sensors that cover 0.38 to 1.8 μm, the ML 93A, features automatic zeroing and an averaging function, and an interface for the IEEE-488 bus. Seven additional optical power sensors can be connected without readjustment.

The high-level sensors use large active-area receptors so that the optical input can be easily modified. The low-level sensors use a light-chopper/synchronous-detection

system that directly modulates the incident light, so that low power levels can be measured with high stability. A small active-area sensor, a slim-style sensor, and a moderate-power sensor are also available.

Power sensitivity of the ML 93A is from –90 to +10 dBm with accuracy to ±5%.

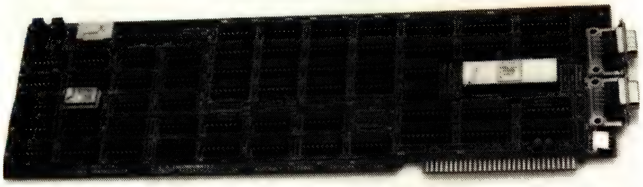
The meter includes sensor connecting cords and is available in either 120- or 240-V models. A rechargeable battery pack is optional. A lower-cost analog unit (the ML 94A) and a portable digital unit (the ML 96A) are also available. The manufacturer will quote prices for all units, and the sensors, on request. All are available now.

Anritsu America, 128 Bauer Dr., Oakland, N.J. 07436.
Phone (201) 337-1111 [Circle 345]

Controllers' resolution is 1,024 by 1,024 pixels

Programmable display resolution to 1,024 by 1,024 pixels on a very-high-resolution monitor is possible with the Ultra-Res models 4-79 and 4-111, two graphics controllers for IEEE-696 bus computers and IBM Corp. Personal Computer compatibles. The 4-79 and 4-111 occupy a single slot in the host computer. Vectors, circles, and arcs are drawn at rates of up to 1 million pixels/s, and zoom from 2× to 16× is provided.

Featured are slave adapters for color or overlays and a transparent mode that allows a monochrome controller and Ultra-Res adapters to drive the same monitor. The Ultra-Res adapter is addressed as an input/output port. The controller presents a standard nine-pin D connector for TTL direct drive, or an analog video signal may be generated. Software drivers are provided in Fortran, and optional drivers include a subset of Plot-10.



The Ultra-Res 4-79 graphics adapter is $955 in single quantities, while the 4-111 is priced at $2,000.

C.S.D. Inc., P.O. Box 253, Sudbury, Mass. 01776.
Phone (617) 443-2750 [Circle 346]

Recorder captures computer images on film or slides

The Matrix Model 3000 Color Graphic Film Recorder is a compact desktop photographic hard-copy unit that transfers computer-terminal images to slides and instant prints in color. Modular film backings for 35-mm slides, 8-by-10-in. overhead transparencies, Polaroid 8-by-10-in. and 4-by-5-in. SX-70 instant prints, and motion picture film are available. The system is simple to use and is field upgradable so that additional film backings can be added later.

Brightness, contrast, color balance, and exposure settings are microprocessor controlled. The system's raster-suppression functions result in improved image quality.

Operation modes include full-spectrum color, red only, green only, blue only, and black and white. The unit measures 10½ in. high by 16½ in. wide by 22 in. deep, weighs 45 lb, and operates on 115 V ac. Input video-signal requirements are RS-170, RS-330, or RS-343 (optional). An RS-232-C interface and foot switch are standard. Video is monitored on a Matrix Model M^2 with 40-MHz bandwidth, 1,400-line-resolution flat face, precision yoke, 1% linearity, switch-selectable interlace control, and automatic brightness compensation.

Highline video, available as an option, uses a Z80 microprocessor and offers a programmable front panel, battery-backed memory, separate digital calibration of red, green, and blue brightness, contrast, and exposure, as well as storage of eight calibration settings for each parameter.

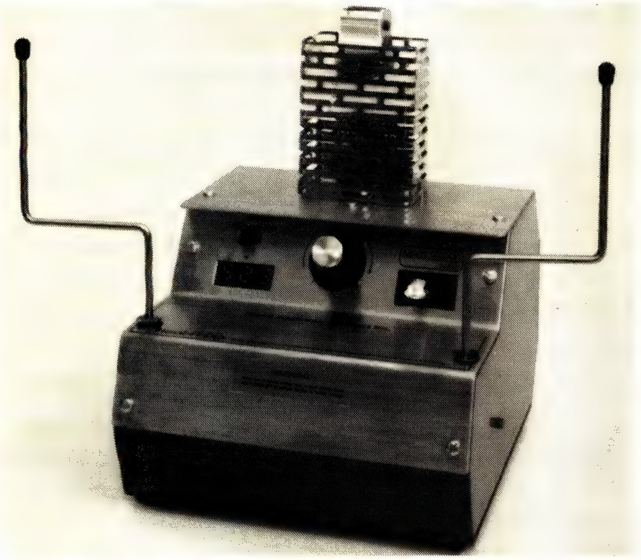
The system can be used for computer-aided design and marketing, sales, technical, and business meetings, according to the company. The model 3000 is priced starting at $8,546, and delivery is within 30 days of receipt of order.

Matrix Instruments Inc., 1 Ramland Rd., Orangeburg, N.Y. 10962.
Phone (914) 365-0190 [Circle 347]

IC removal-and-replacement station handles 6 to 64 pins

A 200-W digital integrated-circuit removal-and-replacement station, the Heat-A-Dip, accommodates 6 to 64 pins on single or multilayer boards. Capable of special applications, it can remove connectors, relays, switches, and so forth. The system is accurate to within 10°F and includes an IC-extraction tool, an IC-insertion tool, and a dross remover.

Teflon protection of the board eliminates burning and



lifting of pads and land areas, according to the manufacturer. The standard system is for ICs with 14 to 16 pins, while the balance of the reworking heads and tools are available as options. In addition, the manufacturer will build special desoldering heads to meet the customer's requirements.

Available from stocking distributors, the Heat-A-Dip (P/N 5003D) sells for $694 in single-unit quantities.

Micro Electronic Systems Inc., 3 Quarry Rd., Brookfield, Conn. 06804. Phone (203) 775-1440 [Circle 348]

Ultrasonic soldering system bonds glass, ceramics, metal

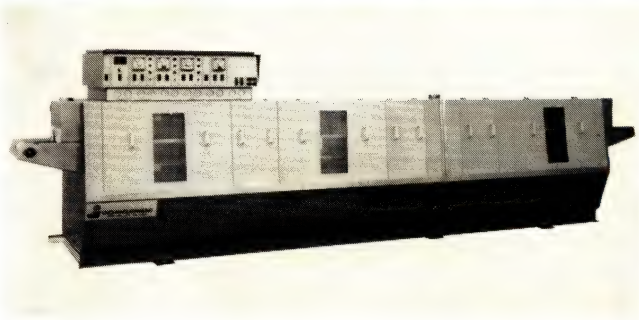
Featuring a proprietary ultrasonic solder dispenser that bonds glass, ceramics, and oxidized and nonoxidized metals without flux, this assembly system requires only the degreasing of surfaces before soldering. The system provides up to 1,000 lb/in.^{2} adhesion and eliminates silver baking before soldering.

The unit is portable, weighing 200 g and measuring 180 by 215 by 80 mm. The manufacturer will send literature on request and will quote prices, which depend on configuration and quantity. Delivery time is 30 days. Larger models for production use are also available, and both price and shipping time will be quoted for these.

Orientation Inc., P.O. Box 2305, Littleton, Mass. 01460. Phone (617) 263-7863 [Circle 349]

Defluxer saves water, reduces contamination

Employing a triple-rinse system, the Hydro-Kleen Model HK55 automatic circuit-board defluxer reduces both the recirculating tank's contaminant level and the amount of water required for the final rinse. Redirecting overflow water into a special prerinse section provides for three rinses instead of two.



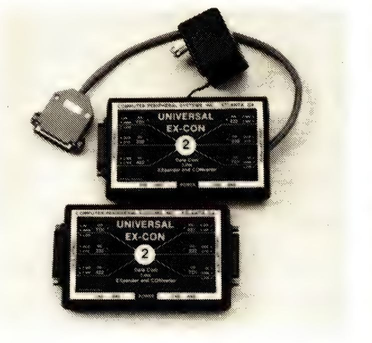
The manufacturer claims innovative use of spray tubes in the major spray sections, rather than nozzles that require frequent cleaning and adjusting. One-piece welded spray manifolds may be removed and reset without tools.

The defluxer's stainless-steel tanks are insulated. Doors are lightweight, color-impregnated fiberglass, with clear panels available. The semimodular unit is 18 ft long, with a 1-ft conveyor belt that moves at speeds up to 10 ft/min. The drying section features a temperature-controlled adjustable hot-air blow-off. Systems can be added for additional dryers or wash or rinse tanks.

Unique Industries, 11544 Sheldon St., Sun Valley, Calif. 91353. Phone (213) 875-3810 [Circle 350]

Unit converts, regenerates data-communications signals

A data-communication-line expander and converter, the Universal Ex-Con, supports RS-232-C, RS-422, and Burroughs TDI (Two-wire Direct Interface) electrical signals. The Ex-Con will convert any of these signals to any of the other signals, and can be used to regenerate any of these signals. It also operates as a line expander or line driver.



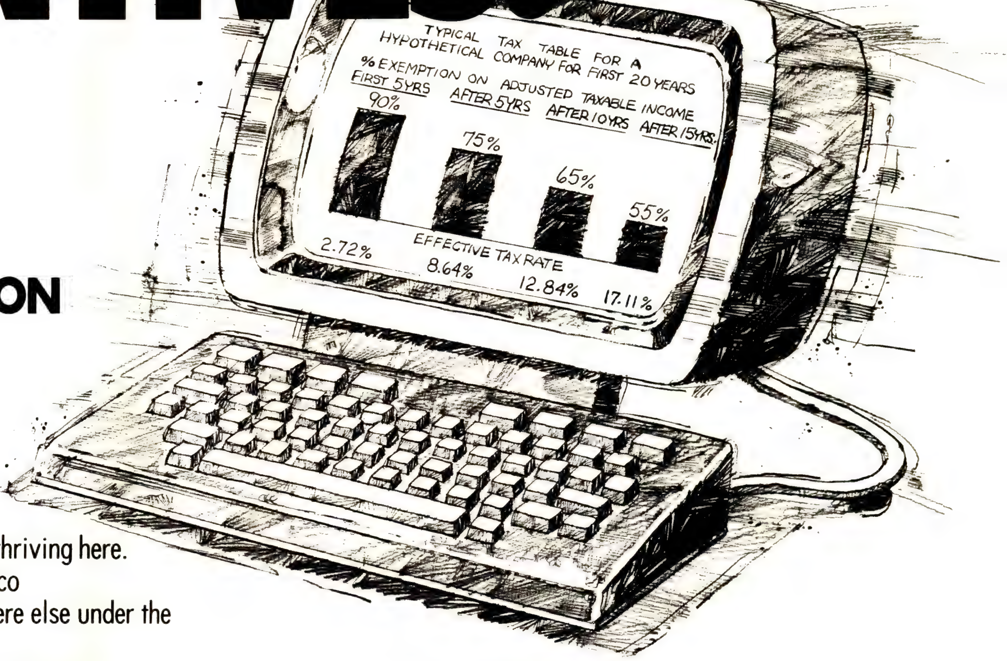
Factory-programmed personality modules make the primary configurations, and jumpers are also available to further define each of the selected input/output configurations. The RS-422 ports can be selected by the user for two or four wires; the two-wire feature permits RS-422 operation over two-wire TDI or telephone cable that may be already in place. The Ex-Con is priced at $225 and is available from stock.

Computer Peripheral Systems Inc., P.O. Box 98282, Atlanta, Ga. 30359. Phone (404) 292-9565 [Circle 351]

Concentrator opens X.25 world to Micro600 users

Users of Micom's Micro600 Instanet local-area networks that are based on a private branch exchange can now access X.25 packet-switched data networks with the Micro800/X.25i Concentrator PAD (Packet Assembler/

UNBEATABLE INCENTIVES.


TYPICAL TAX TABLE FOR A HYPOTHETICAL COMPANY FOR FIRST 20 YEARS
% EXEMPTION ON ADJUSTED TAXABLE INCOME
FIRST 5YRS
AFTER 5YRS
AFTER 10YRS
AFTER 15YRS
90%
75%
65%
55%
EFFECTIVE TAX RATE
2.72%
8.64%
12.84%
17.11%

HOW YOUR BUSINESS PROFITS FROM THE INDUSTRIAL EVOLUTION OF PUERTO RICO.

3¼ million U.S. citizens—the people of Puerto Rico—have worked to make their Island the ideal second home for American business.

Now, over 100 of the Fortune 500 are thriving here.

One strong reason why: the Puerto Rico incentives package is unmatched anywhere else under the U.S. flag.

The result is increased returns on investment for companies doing business here.

No Federal tax on corporate income. Your profits go back to the U.S. Mainland, whenever you choose, subject to a nominal tollgate tax.*

Local tax incentives. The local withholding tax for business is only 10%, and reinvestments can reduce that to 5%. In some cases, to 0%.

Total tax exemption from municipal taxes is offered to grantees established under the industrial program.

In addition, exemptions from all local and state taxes on corporate earnings, real estate, personal property and municipal taxes begin at 90%. While they gradually decrease, they last for 10 to 25 years, depending on your geographic location.

5% Production Worker payroll deduction, available to qualified manufacturing firms, rewards high wages and high employment and can bring your effective tax rate down as low as 2.7 to 4.5%. For example, if your company earns $1,000,000 in net profit, and incorporates the payroll deduction, you would be taxed at an effective rate of just 2.72% during your first five years. And your firm would pay only $27,200 in corporate taxes.

Important new incentives for service industries. The Service Industry Tax Act of 1983 provides 75% tax exemption from corporate and property taxes for 5 years, for qualified service firms in 22 industry classifications. Among the qualification regulations, all company services must be exported.

Tax incentives are only the beginning. You may come for the incentives, but you'll stay for the highly-skilled, productive workforce. With high-level technical training and managerial skills.

"More than one thousand U.S. Mainland businesses have opened a factory or service facility here, helping to bring about our Industrial Evolution.

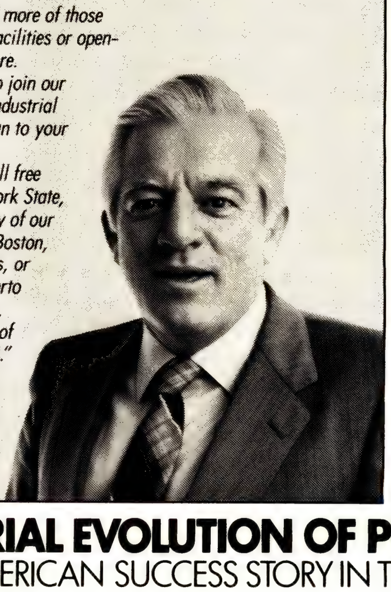
"Today we see more and more of those businesses enlarging their facilities or opening a second or third, or more.

"I invite your business to join our Evolution. Learn what our industrial incentives program can mean to your profits picture.

"Call Raúl Escudero at toll free (800) 223-0699; in New York State, (212) 245-1200. Or call any of our regional offices in Atlanta, Boston, Chicago, Dallas, Los Angeles, or San Francisco. Or write: Puerto Rico Industrial Development, Dept. ELW-6, 1290 Avenue of the Americas, NY, NY 10104."

Carlos Romero Barceló

Carlos Romero Barceló,
Governor of Puerto Rico



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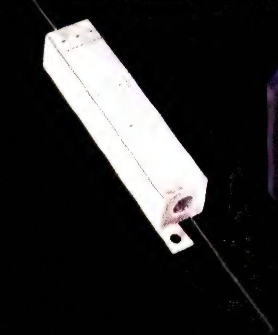
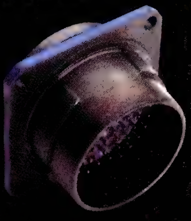
*U.S. Internal Revenue Code Sections 936 and 243(b)(I)(C). Section 936 companies are allowed to bring current profits home (as determined under TEFRA, 1982) without U.S. taxes. However, a Puerto Rico tollgate tax on distribution dividends of 10% or less, depending on the conditions under which funds are repatriated, will be levied.

©1984 Puerto Rico Economic Development Administration.

In addition to high reliability, custom-designed capacitors similar to this metal encased, hermetically sealed unit, the Capacitor Division manufactures a complete line of precision, environmental-resistant and metallized film/foil capacitors.



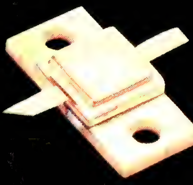
The extensive product line of the Cylindrical Connector Division includes MIL-C-38999, MIL-C-83723 and MIL-C-26500 in more than 10 shell sizes and 33 insert types used in aircraft, missiles, avionics and ground support equipment.



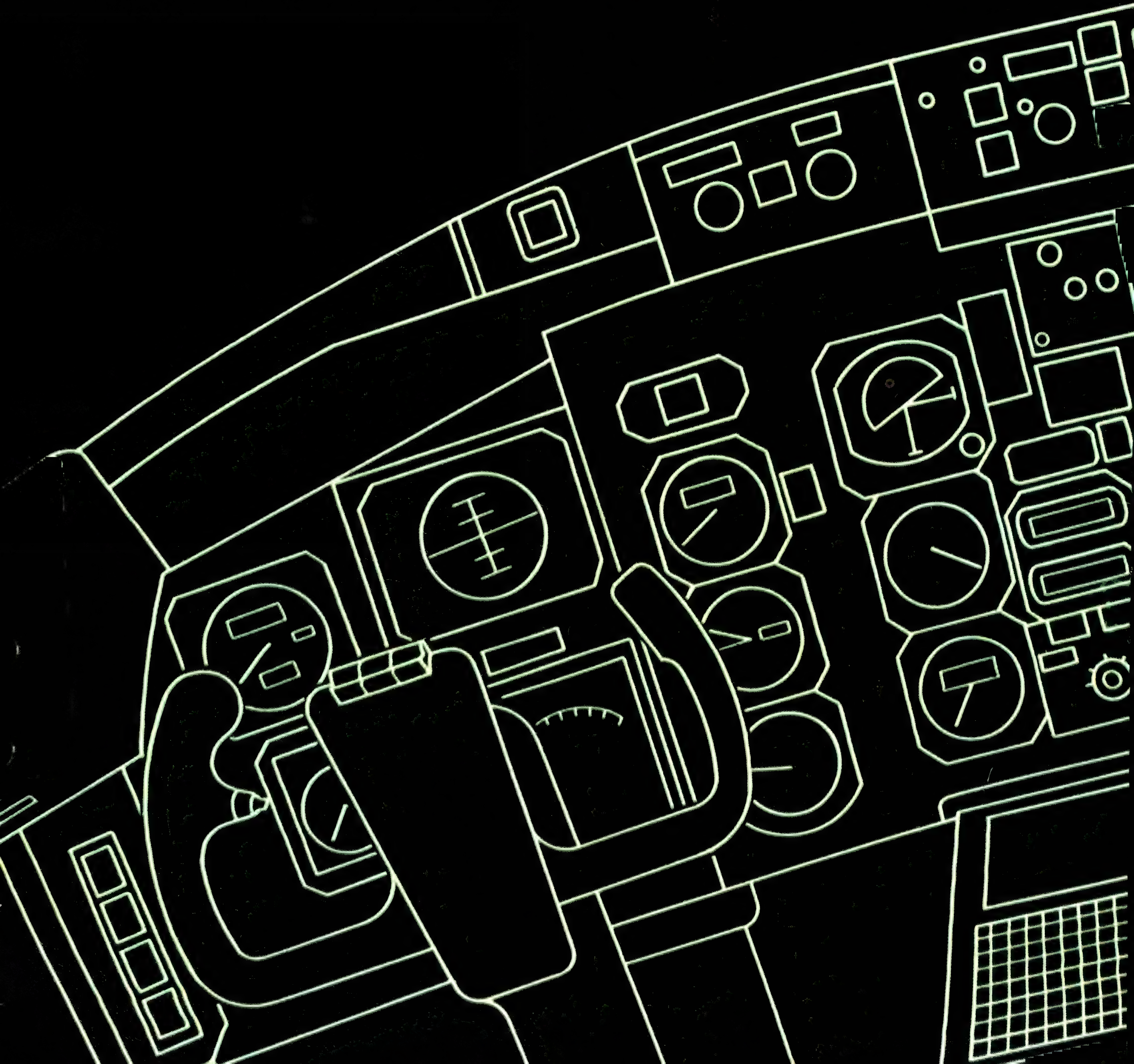
Connector Division's micro-miniature Dura-Con™ high reliability connector is ideal for minimum weight and space applications requiring maximum shock and vibration resistance ...in six housing styles and in custom harness assemblies.

This fuel transfer pump is typical of the pumps, torquers, tachs, actuators, blowers and other motorized assemblies built by the Motor Division to MIL-Q-9858A, using the Division's own precision motors and gearmotors.

The MRA 1214-55H microwave power transistor, rated at 50W CW, 100 W pulse, 6.5 dB gain and 1200-1400 MHz for radar, ECM and other L-Band systems, is typical of the leadership of the RF Devices Division in RF semiconductor research.



The broad line of GaAlAs infrared LEDs from the Optoelectronics Division is typified the OP231 Series that closely match the spectral response of silicon phototransistors, f improved coupling efficiency.



Jsed in radar/sonar devices, the TDC1025 i0 MegaSample/sec ull parallel A/D converter from the LSI Products Division, he acknowledged eader in digital signal processing, can convert an analog signal of up to 2 MHz into 8-bit ligital words.

The full line of MIL specification products from the Electronic Assemblies Division includes this MPX Series that fully meet MIL-STD-1553 and MIL-T-21038 for command/response Multiplex Data Bus transformers.

Chip carrier resistor networks, like these 19 resistor, 20 pin, 0.128" square units are representative of the industry's broadest line of resistive devices from the Resistive Products Division.

For aircraft and defense products...

Because long experience with these industries has given TRW knowledge and capability that is unsurpassed.

The products shown here are typical of TRW's broad involvement in the aircraft and defense marketplace. Many of the products represent the efforts of several divisions, combining their expertise to provide the right product for your needs.

More information about TRW advanced technology, precision products is available from any Electronic Components Group sales office...or from the many distributors that stock TRW components.

For a new booklet entitled, "Strategic Ideas from a Components Company called TRW," write Marketing Communications,
TRW Electronic Components Group,
2525 E. El Segundo Blvd.,
El Segundo, CA 90245.

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Connector Division
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Optoelectronics Division
Resistive Products Division
RF Devices Division
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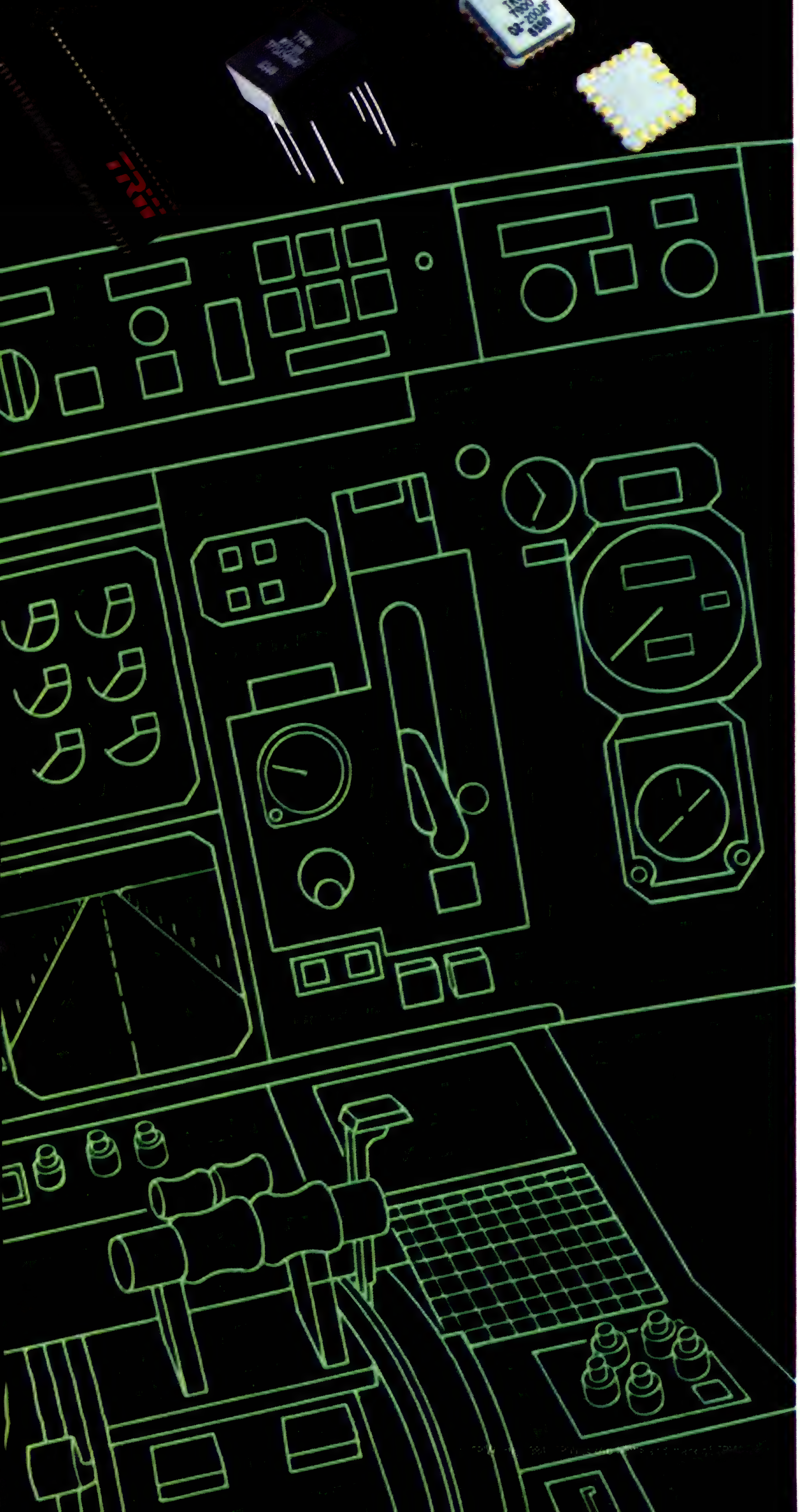
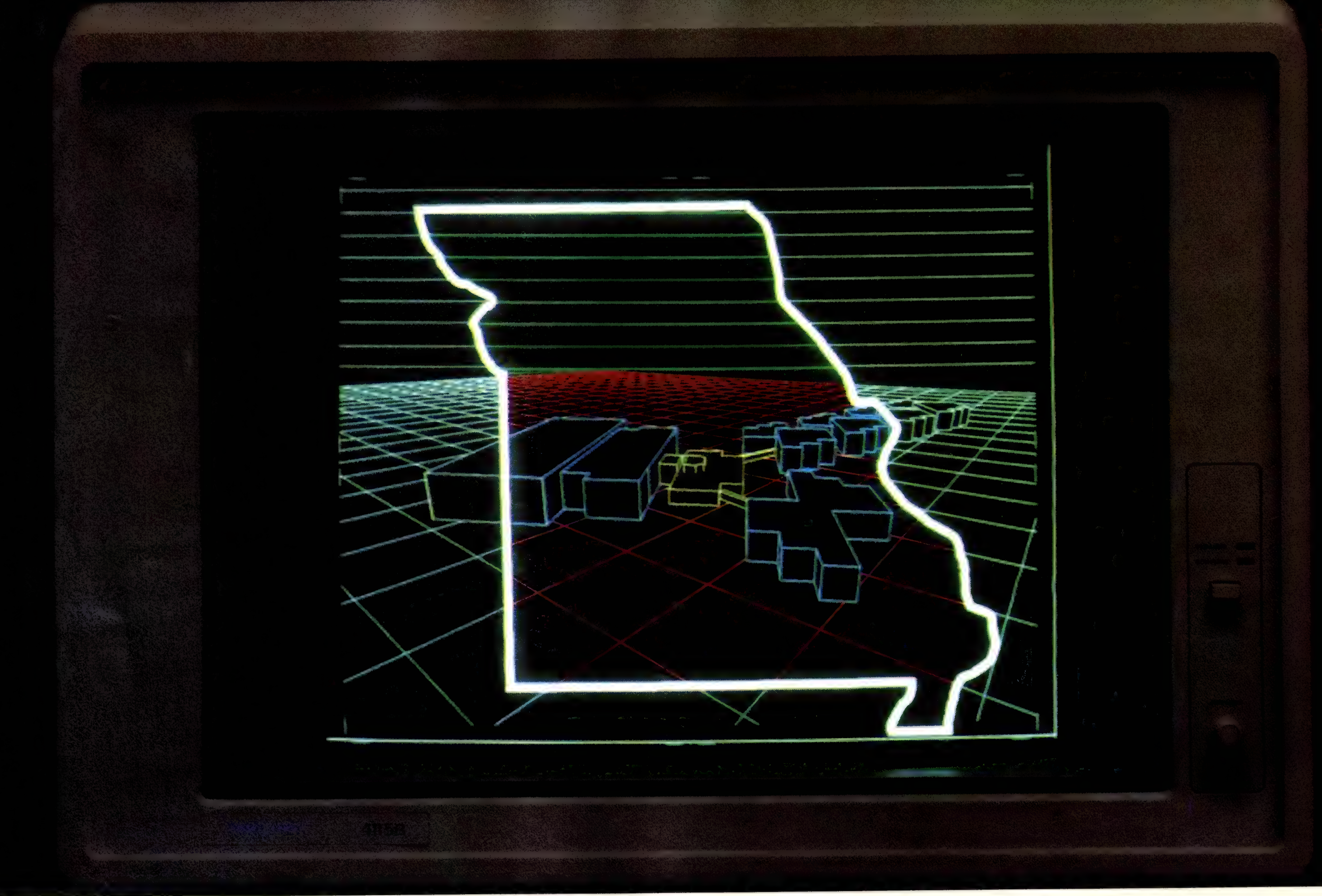
TRW

TRW Electronic Components Group

Circle 127 on reader service card





The St. Louis campus of McDonnell Douglas Automation Company as modeled by McAuto's Building Design System.

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Every day, dreams become reality at McAuto, the worldwide computer services division of McDonnell Douglas Corporation. Here, a special combination of innovative ideas and technological advances is helping to shape our future. Buildings, machinery, and even jogging shoes are designed, tested and analyzed not on drawing boards, but on computer systems designed by McAuto. And it all takes place here in Missouri.

Bob Fischer, president of McAuto says, "People are our most vital resource. We've had great success in attracting and keeping the high quality work force our business demands. Our average employee has been with McAuto for eight years, a figure far above the industry average. Many come from colleges and universities located throughout the state. Others relocate here and find they like McAuto's atmosphere and they like living in St. Louis."

If you need a quality work force to turn your high tech dreams into reality, you belong in Missouri.
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MISSOURI
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Circle 128 on reader service card

Disassembler). These X.25 networks can link Micro600s to terminals, computers, and other Micro600s.

The concentrator accepts data from up to 16 terminals or computer ports and performs the necessary packet assembly/disassembly and protocol to access an X.25 network. It can also communicate with local host computers supporting X.25 software, providing up to 16 full-duplex logical data channels over a single hardwired connection to one X.25-supported computer port.

Compatible with CCITT Recommendations X.3, X.25, X.28, and X.29, the Micro800/X.25i supports both permanent and switched virtual circuits, plus fast select, abbreviated calling, closed user groups, throughput class negotiations, channel priority assignment, and password protection. A built-in Command Facility, accessible through either a Command Port or the X.25 network, supports managerial functions, such as setting or changing terminal channel configuration data, performing network diagnostics, and collecting network operating statistics.

The Micro800/X.25i ("i" stands for "integral") is a Micro600 plug-in card module implementation of Micom's Micro800/X.25 Concentrator PAD, which is certified by Telenet, Tymnet, and Uninet in the U.S., and various other public packet networks worldwide. An eight-channel Micro800/X.25i sells for $2,500 and a 16-channel version is $4,200. The units are currently available and can be shipped within 60 days of receipt of order.

Micom Systems Inc., 20151 Nordhoff St.,
Chatsworth, Calif. 91311.
Phone (213) 998-8844 [Circle 352]

Infrared atmospheric system bypasses phone lines

An optical infrared system, the model ALS829-T1, transmits T1 (1.544-Mb/s) signals through the air over line-of-sight distances of up to 1.5 miles, as an alternative to microwave, telephone lines, cable, and fiber-optic channels. The manufacturer also says that the transmitter-receiver system will cross fields of electromagnetic interference to link one building to another in a local-area network, and that it is secure and untappable.

The ALS829-T1 is compatible with any system whose output follows the Bell T1 standard protocol, and it offers full-duplex, half-duplex, or repeater capability. There is no Federal Communications Commission licensing requirement.

The units are designed to operate outdoors, within a temperature range from –20°F to +150°F. The price of $14,000 is for full-duplex capability (including interface boxes); delivery is from stock.

American Laser Systems Inc., 106 Fowler
Rd., Goleta, Calif. 93117.
Phone (805) 967-0423 [Circle 353]

RS-232-C switch allows port-to-port connections

A low-cost private local-area network is one possible application for the SS-16 Smart Switch, a 16-port RS-232-C switching device. The unit allows port-to-port connection for computer expansion and linking of terminals, modems, printers, and work stations.

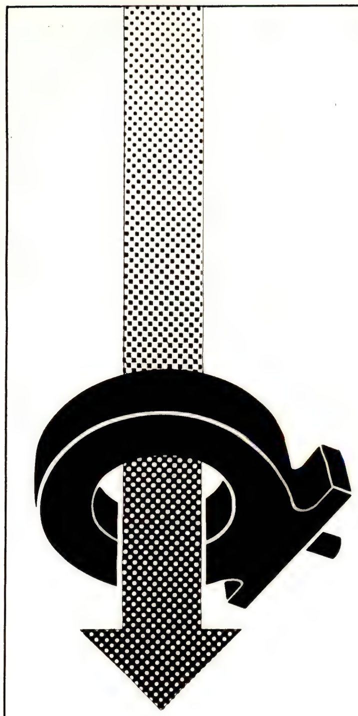
Each of the 16 individual RS-232-C ports can be configured for independent baud rates (ranging from 150 b/s to 19.2 kb/s), parity conversion, and handshake protocol. Ports may be selected by number, name, or in groups, with up to eight simultaneous connections. Quick selection, disconnection, and display of port activity are accomplished by means of menu-driven commands.

Additional features include security access levels, connect-disconnect of remote ports, and a no-activity time-out. The unit sells for $1,895, and will be available in January 1985. Delivery is within 30 days.

Western Telematic Inc., 2435 S. Anne St.,
Santa Ana, Calif. 92704.
Phone (714) 979-0363; outside California,
(800) 854-7226 [Circle 354]

Helium-leak detector meets military testing standards

Sealed microelectronic devices can be production-tested under MIL-STD-883, -750, and -202 by the model MS-20 UFT helium-leak detector,



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CURRENT MONITOR

With a Pearson current monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, including those at very high voltage levels.

This monitor is physically isolated from the circuit. It is a terminated current transformer whose output voltage precisely follows the current amplitude and waveshape. A typical model gives an amplitude accuracy of +1%, −0%, 20 nanosecond rise time, droop of 0.5% per millisecond, and a 3 db bandwidth of 1 Hz to 35 MHz. Other models feature 2 nanosecond rise time, or a droop as low as 1% per second.

Whether you wish to measure current in a conductor, an electron device, or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ½″ to 10¾″ ID) will do the job. We also provide custom designs to meet individual specifications.

Contact us and we will send you engineering data.

PEARSON ELECTRONICS, INC.
1860 Embarcadero Road
Palo Alto, Calif. 94303, U.S.A.
Telephone (415) 494-6444
Telex 171-412

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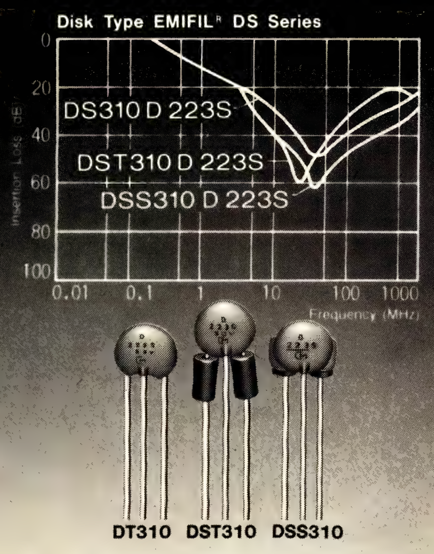
Circle 167 on reader service card

ELIMINATES NOISE FROM MICROCOMPUTERS



DT310 DST310 DSS310

■**Features** ●Murata's disc-type "EMIFIL®" is a T-type EMI filter with large insertion loss. ●It ensures the best possible noise prevention because after selecting capacitance, it is then tuned to perfectly meet the freguency to be suppressed. ●Accurate mounting on any P.C. Board.

■**RATINGS**

Part Number	Capacitor			Ferrite Core.
	Capacitance	Rated Volt.	Temp. Char.	
DSS310-55Y5S220M DSS310-55Y5S470M DSS310-55Y5S101M	22pF±20% 47pF±20% 100pF±20%	100V	±10%	inside
DS 310-55Y5S271M DST310-55Y5S271M DSS310-55Y5S271M	270pF±20%	100V	±10%	none outside inside
DS 310-55Y5S222M DST310-55Y5S222M DSS310-55Y5S222M	2200pF±20%	100V	$^{+20}_{-30}\%$	none outside inside
DS 310-55Y5S223S DST310-55Y5S223S DSS310-55Y5S223S	$22000\text{pF}^{+50}_{-20}\%$	50V	$^{+20}_{-30}\%$	none outside inside

※Murata's series of disc-type EMI filters use a max. of 7A of current capacitance between terminals each 2.5+/−0.5mm apart.

Uses Noise elimination from any microcomputers, including calculators, office computers, personal computers, word processors, PPCs, facsimiles, VTRs, microwave ovens, automotive electronic equipment and industrial equipment.

ELIMINATING EMI FROM SHF BANDS

EMIFIL®

Disc Type

Kinds of "EMIFIL®" and its use for noise removal (DC noise filter: Disc-type, Block-type, and Through-type "EMIFIL®" series) "EMIFIL®" filters are also made available for AC noise filter, Common-mode choke filter, filtered connector, and other noise filters, covering a range from 10KHz to 15GHz.

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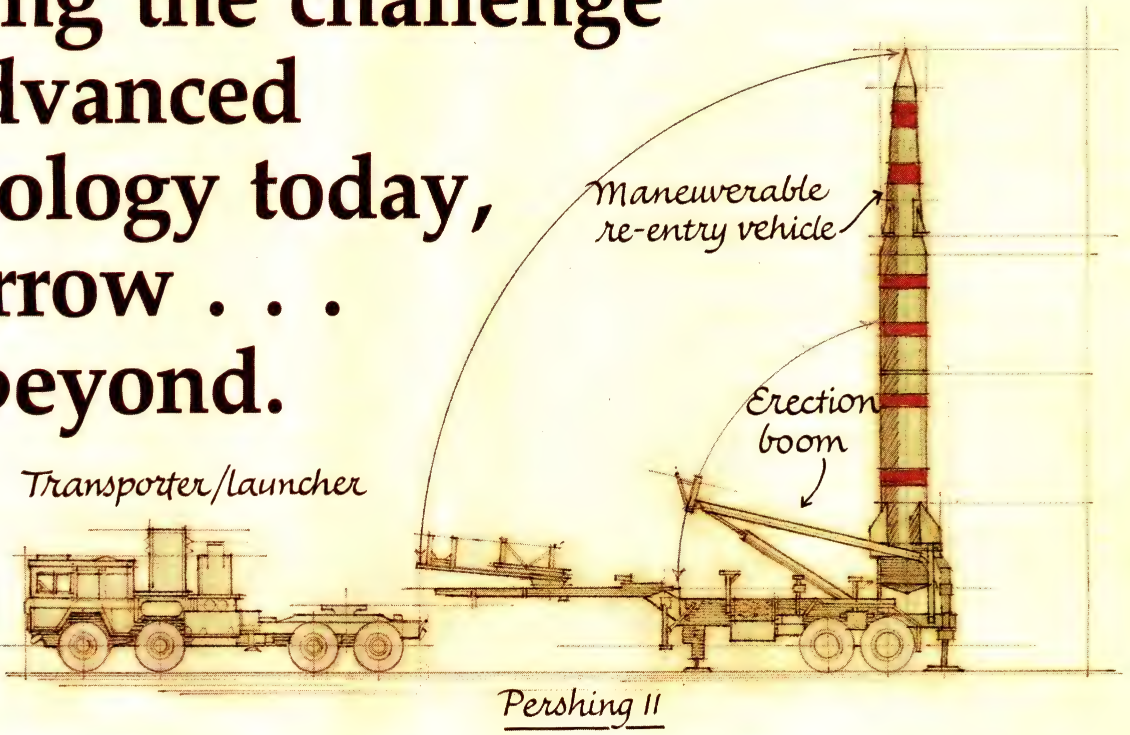

At Martin Marietta Aerospace, we're advancing the role of technology to meet the ever-increasing demand for innovative, technically superior defense and space systems. The Pershing II being produced in Orlando, Florida, is the Army's most powerful missile system. With this system, Martin Marietta has again brought into play advanced technology, utilizing highly sophisticated propulsion and terminal guidance systems for increased range and accuracy. Our successes also include the Patriot air defense missile and the Copperhead laser-guided projectile, as well as a broad range of other on-going, challenging projects.

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- Quality Engineers
- Systems Engineers
- Composite Engineers
- Software Engineers

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- Facilities Engineers
- Quality Engineers
- Design/Liaison Engineers
- Stress Engineers
- Propulsion Engineers
- Programmer/Analysts
- Test Engineers (EE)

a fully automatic testing system. To initiate the test cycle, the operator loads the parts and closes the chamber lid, and the leak rate is digitally displayed for either direct helium or air-equivalent readout on the remote box. Accept-reject indicator lights eliminate operator judgment.

Microprocessor self-diagnostics pinpoint and display fault locations. The test cup, with its 150-cm^3 volume, is said by the manufacturer to give fast cycling, and a dual-sector mass spectrometer tube provides a resolving power of 14 at mass 4.

The model MS-20 UFT leak detector has a price tag of $18,500, with a delivery time of 12 to 14 weeks after receipt of order.

Veeco Instruments Inc., Industrial Equipment Division, Terminal Dr., Plainview, N.Y. 11803. Phone (516) 349-8300 [Circle 355]

Inexpensive functional tester is suitable for repair depots

Functional circuit-board testing at low cost is offered by a new version of the company's Sense 1 system, aimed at small- to medium-sized manufacturers and repair depots.

Driven by a 16-bit microprocessor with 128-K bytes of memory, Sense 1 includes dual floppy-disk drives, printer, monitor, and keyboard integrated into a table console unit.

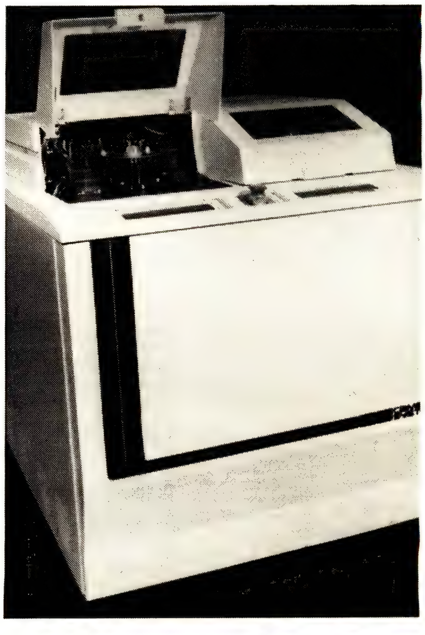
Its 96 driver/sensor pins, expandable to 192 pins, can test on-board memory, measure frequencies, pulse, and voltages, or analyze digital and analog signatures. The test system self-learns the nodal responses from a known-good board. Programming is interactive and menu driven. Available options include an IEEE-488 interface. The system sells for $38,000 and shipment takes three months.

Sense Test Systems Inc., P.O. Box 855, Racine, Wis. 53403.
Phone (414) 637-1005 [Circle 356]

Disk-drive system tests 5¼-in. Winchester drives

A portable disk-drive test system, the CS-1000, is designed for development testing, manufacturing, final testing, quality control, receiving and inspection, and field service. It can also be used by drive manufacturers, original-equipment manufacturers, and end users.

The CS-1000 tests 5¼-in. Winchester disk drives in stand-alone or rack-mounted applications. For multilevel, volume-test applications, it is networkable. It is also said to provide a uniform means of measuring



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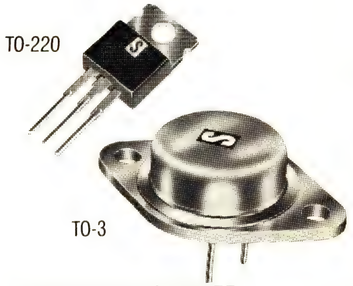

- EUTECTIC MOUNTED
- HIGH RELIABILITY
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- GREATER SOA
- NO SECONDARY BREAKDOWN
- UP TO 800 VOLTS
- UP TO 8 AMPS

Solitron's SWITCHMOS technology combines hexagonal geometry with the most advanced design and processing techniques, resulting in power MOSFETS with exceptional performance and reliability. Available in standard TO-3 and TO-220 cases, as well as other packages if requested, typical specifications include:

TYPE NO.	I_D	V_{DS}
SDT10	12A	50V
SDT15	45A	50V
SDT20	12A	100V
SDT27	26A	100V
SDT30	7A	200V
SDT38	18A	200V
SDT60	5.5A	400V
SDT63	3.5A	400V
SDT44A	4.8A	500V
SDT74	2.4A	500V
SDT80	2.6A	800V
SDT84A	6.0A	800V

For complete information, contact Sales Dept. toll-free 1-800-327-8462.

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1177 Blue Heron Blvd.
Riviera Beach, Florida 33404
(305) 848-4311/TWX: (510) 952-7610

Circle 134 on reader service card

timing-window margins for disk drives.

It provides self-diagnostic and testing features. The dual-pattern generators, in the read/write mode, permit simulated test conditions and verification of window margins during actual testing, and before connection to a disk drive, without disrupting a test in progress.

Weighing 20 lb, the disk drive tester uses a liquid-crystal display to show two lines of menu data simultaneously and has a calculator-style keyboard with color-coded keys for the range of modes. A sliding panel closes over the keyboard and display to protect it when it is used in the field.

Cambrian Systems Inc., 31364 Via Colinas, Westlake Village, Calif. 91362. Phone (818) 991-7026 [Circle 357]

Sperry enters Unix market with full product line

The 5000 series of multiuser microcomputers and the 7000/40 superminicomputer system have been added to Sperry Corp.'s personal computer and 1100 series to build a micro-to-mainframe family around the AT&T Bell Laboratories Unix System V operating system. These computers connect with other Unix systems, as well as with IBM Corp. mainframes and the manufacturer's own mainframes, in terminal-emulation and data-sharing modes.

The 5000 series includes four models based on the MC68000 microprocessor. Each can handle up to 64 users.

The modular system architecture is designed to accommodate such enhancements as 32-bit microprocessors, high-density random-access memories, and ever-higher-capacity disk drives. The dual-bus design preserves the independence of system functions.

The 7000/40 system, supporting up to 128 users, runs Unix V and the C language. Its storage capacity is from 4 to 8 megabytes of main memory, and with its 32-bit bus structures, the system can process three instructions simultaneously.

A separate subsystem for the central processing unit, main memory, and input/output distributes communications handling, and memory capacity with four-way interleaving permits several controllers to access memory simultaneously.

Prices for the 5000 series range from $15,000 to $50,000 for the low-end models, and from $62,000 to $150,000 for the high-end models. The 7000/40 system's price range is from $160,000 to $300,000, depending on configuration.

The 5000 series models 20 and 40 will be shipped at the end of January 1985, models 60 and 80 at the beginning of March. The 7000/40 system will be available Feb. 1.

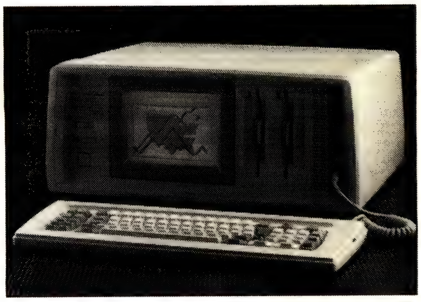
Sperry Corp., Information Systems Group, P.O. Box 500, Blue Bell, Pa. 19424. Phone (215) 542-4213 [Circle 358]

Portable computer offers 25-line color screen

At an affordable $2,599, the MBC 775-PC portable computer comes standard with an 80-column-by-25-line color screen with a resolution of 640 by 200 pixels. Sixteen colors can be displayed at once.

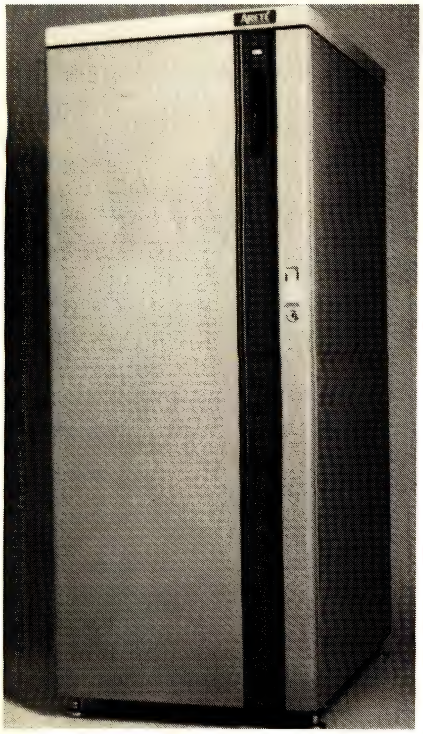
The MBC 775's software is the MS-DOS operating system plus GW-Basic. A Centronics parallel port and two expansion slots that will accept IBM Corp. Personal Computer-compatible add-on boards from third-party vendors are standard. Options include an RS-232-C serial port and an expansion memory board.

Sanyo Business Systems Corp., 51 Joseph St., P.O. Box 387, Moonachie, N.J. 07074. Phone (201) 440-9300 [Circle 385]



Multithread architecture couples four 32-bit CPUs

A family of multiple 32-bit processor systems relies on the manufacturer's proprietary multithread architecture,



which has a 33.3-megabyte/s input/output data-transfer rate, to optimize memory access and interprocessor communications. Thanks to this architecture, four 32-bit microprocessors have been coupled in the model 1200 series.

In addition to four 12.5-MHz 68000 CPUs, the 1200 series offers 12 I/O controllers, 16 megabytes of error-detecting and -correcting main memory, and up to 88 asynchronous and synchronous serial communications ports, permitting as many as 88 users to access the 9 gigabytes of storage on four internal and 44 external disk drives.

The 1200 series supports Arix (Unix System V, release 2) and the Cobol-compatible RM/COS operating systems. Identical Cobol compilers exist under both RM/COS and Unix so that Cobol software developed under Arix can run under RM/COS at much higher speeds.

Power margining is designed in, and extensive burn-in before shipment also enhances reliability. Priced from $70,000 to $150,000, the 1200 series computers are shipped in 60 days.

Arete Systems Corp., 2040 Hartog Dr., San Jose, Calif. 95131.
Phone (408) 263-9711 [Circle 386]

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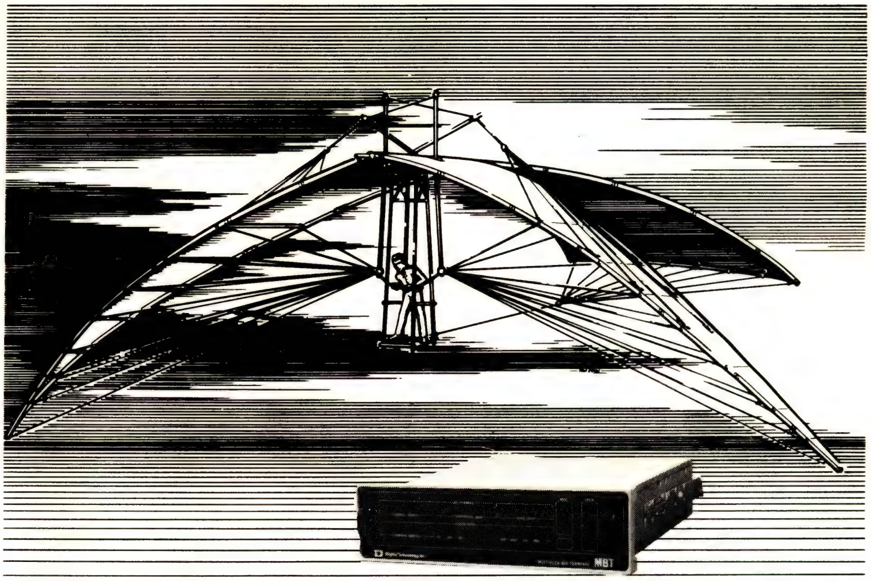

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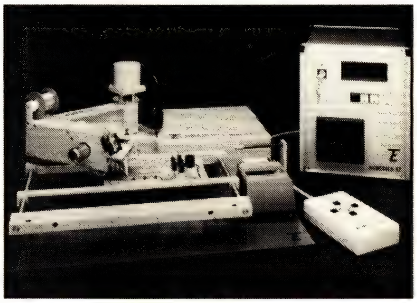
Robot tackles small-scale and odd soldering jobs

A tabletop robotic work station is intended for soldering printed-circuit boards for personal computers when mass soldering techniques are neither possible nor practical. Called Memosold, the work station is useful when components must be added to the pc board after mass soldering, when heat soldering is a problem, or when components need to be added to the top side of a board.

Memosold, which can fit onto any standard bench or work station, can also be used when components that are sensitive to flux fumes are used and when physical obstructions do not allow mass soldering.



With the station, about 1,500 positions can be stored for a given soldering job, and each position can have its own set of parameters. For larger jobs, programs can be linked. Soldering temperature, amount of solder applied, and the length of time the soldering iron is in contact with the joint can be varied.

Priced at $18,500, the work station can be delivered within 12 weeks.

Peter Fodor Associates Inc., Overseas Consulting & Sales Division, Commerce House, Suite 1630, 1080 Beaver Hall Hill, Montreal, Quebec, Canada H27 1T2.
Phone (514) 397-9933 [Circle 371]

Version of Abel runs on Valid CAE work stations

A version of Abel, a logic-design language that compiles any combination of Boolean equations, truth tables, or state diagrams into fuse maps for any type of programmable logic chip, is now available for use on computer-aided engineering work stations manufactured by Valid Logic Systems Inc. Abel now runs on release 7.0 of Valid's Scaldsystem I, II, and IV, as well as on the Scaldstar.

These work stations also provide board- and chip-level design functions, such as schematic entry, timing verification, logic simulation, and physical design.

To streamline programmable logic designs, board-level design systems must be able to quickly reduce the engineer's original equations into the binary fuse maps required by the chip. Abel provides this compatibility by letting the engineer use any combination of the Boolean equations, truth tables, and state diagrams. It minimizes equations and converts them into a fuse map for the chip, and at any point in the design phase, the engineer can use Abel's integrated simulator to test and edit the design before proceeding. Abel has a library containing over 95 types of programmable logic chips.

Available now, Abel sells for $2,495; subsequent copies to the same customer sell for $1,875.

Data I/O, Customer Service, 10525 Willows Rd. N.E., P.O. Box 97046, Redmond, Wash. 98073.
Phone (800) 426-1045 [Circle 372]

Motion detector monitors speed, time, linear motion

A compact, self-contained motion detector, Telemecanique Inc.'s model XSA-V monitors rotation speeds as well as time intervals and linear motion. A potentiometer on the rear of the unit can be adjusted to set a

threshold speed level. When the revolutions per minute of the monitored object fall below the set speed, the detector's solid-state output opens.

The XSA-V is enclosed in a 30-mm-diameter cylindrical, threaded, chromed-nickel brass housing. On startup, a built-in delay of 9 s enables the monitored object to reach full speed. A light-emitting diode is provided to indicate when the output is energized.

Two speed ranges are offered: the model V111 can be adjusted from 6 to 150 rpm, the model V121 handles 120 to 3,000 rpm. Four voltage ranges—12/48 V dc, 24/48 V dc, 110/120 V dc, and 220/240 V dc—are available.

Telemecanique Inc., 2525 S. Clearbrook Dr., Arlington Heights, Ill. 60005.
Phone (312) 437-1150 [Circle 381]

Sputtering system processes 100 6-in. wafers per hour

A sputtering system, the Plasmafab MS6200, is a cassette-loading, in-line magnetron system with dual cassette-handling stations. The MS6200's throughput is up to 100 wafers per hour, and it can process 4-, 5-, and 6-in. wafers with practically no delay when switching from size to size, the firm says.

The MS6200's major functional parameters include a deposition uniformity across the wafer of ±3%, ±4%, and ±5% for 4-, 5-, and 6-in. wafers, respectively. Its deposition temperature range extends to 320°C. Other benefits of the system include high reliability, low particulates, and minimal downtime, according to the firm.

Deliveries take 26 weeks after receipt of order. Prices start at $465,000.

ET Electrotech, 400 Oser Ave., Hauppauge, N.Y. 11788.
Phone (516) 231-3700 [Circle 373]

Upgraded controller units handle higher power levels

To upgrade its PC20 programmable controller, the company has released two 16-channel modules specified at up to 48 V, compared to the 24 V of previous modules. With double the

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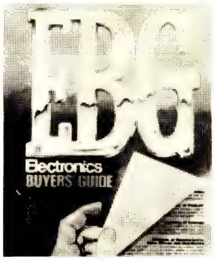

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Circle 170 on reader service card

voltage rating, the IM23 (input) and OM23 (output) modules can handle much higher power levels, thereby improving system noise immunity in industrial or other noisy environments.

The IM23 and OM23 are both equipped with front-panel light-emitting diodes for channel-status monitoring. The channels are isolated from the internal logic of the controller by photocouplers.

Samples of the IM23 and OM23 are available now. Prices depend upon the importing country, and inquiries should be made of the manufacturer.

Philips ECG, 50 Johnson St., Seneca Falls, N.Y. 13148.
Phone (315) 568-5881 [Circle 382]

Pressure sensor suits battery or solar-power uses

A low-power pressure sensor, designated the Miser 35 series, is designed for remote-pressure and differential-pressure applications where battery or solar power is required. The 35 series incorporates the same sputtered thin-film strain-gauge technology used in the firm's pressure-instrumentation products.

The line comprises a differential pressure sensor, an absolute sensor, a sealed gauge pressure sensor, and a true gauge pressure sensor. With an output proportional to the pressure of 0 to 5 V dc, the lightweight 35 series products operate on a 6-to-12-V dc power supply. Outputs that can be set are 0 to 5 V dc, 0.5 to 4.5 V dc, 0.8 to 4.0 V dc, or 1.0 to 5.0 V dc.

Each unit's range ability can be adjusted to one-third of its full range, allowing a 30-lb/in.^{2} (true gauge) pressure sensor to be adjusted down to a range of 10 lb/in.^{2} (true gauge). The zero setpoint can be adjusted to –50% elevation or +50% for suppression. Both zero and span adjustments are made externally through adjustment magnets.

The 35 series will draw only 1.5 mA of current under normal operating conditions. This equates to less than 9 mW of power at 6 V dc. The warmup time is less than 100 μs at 80°F, making it ideal for remote polling applications where timing is crucial. The units come with three connection leads, a positive power, and a positive output.

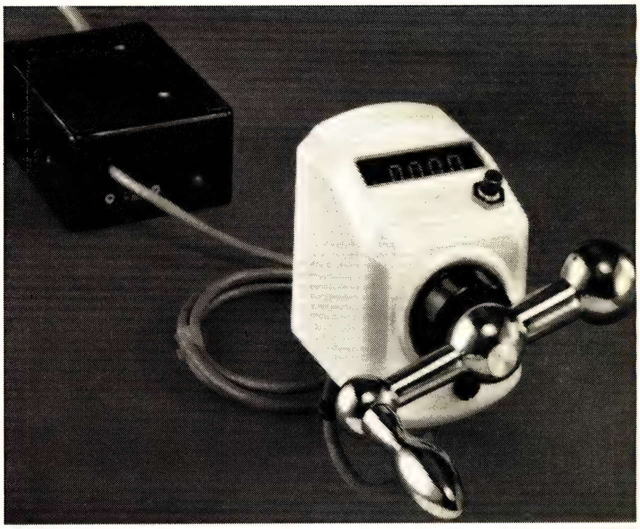
Priced at $800 or $900 for a gauge or differential unit, the sensors are available in 10 weeks.

Gould Inc., Gould Measurement Systems Division, Oxnard, Calif. 93030. Phone (805) 487-8511 [Circle 380]

Position indicators offer four-place digital readings

Shaft-mounted, digital position indicators show the exact position of leadscrew nuts or other devices in places where linear movement is created by turning a shaft. The instruments will display both negative and positive readings on four-digit light-emitting diodes.

Counter ranges extend up from 0 to 9,999 and down from 0 to –9,999, showing movements as small as 0.001 in. The two models, 05E and 05EP, are calibrated for common screw-travel rates and will accept and generate binary-coded decimal inputs and outputs used for automatic-machining or preset capability.



The indicators, which operate on 5 V dc, can be mounted to shafts of up to ¾ in. in diameter. An optional handcrank executes a change in position.

At a base price of $280, the indicators are available within four months.

Siko Corp., P.O. Box 1461, Ann Arbor, Mich. 48106.
Phone (313) 426-3476 [Circle 379]

Oxide-isolated PROMs have access times of 25 to 40 ns

Four oxide-isolated programmable read-only memories have typical maximum access times that vary from 25 ns for commercial grade (0°C to +70°C operating temperature range) 16-K memories to 40 ns for military-rated 32-K parts (–55° to +125°C). The 16-K and 32-K TTL PROMs, the first in a high-speed line that will include a 64-K version planned for introduction in early 1985, have a speed capability resulting from the use of the firm's HS2Z process technology. The process combines features of oxide isolation and vertical fuse techniques.

PROMs made with HS2Z demonstrate low power dissipation and very high field fusing yields, according to the company. Applications for the devices include data processing, telecommunications, and military equipment that performs functions such as sequential control, microprogramming, random logic, and code conversion. The memories are field programmable.

The 4-K-by-4-bit 16-K PROMs include on-chip decoding and have two chip-enable inputs for memory expansion. They do not require separate fusing pins, and they feature three state outputs.

The 32-K PROMs are organized in a 4-K-by-8-bit fashion. Both the 16-K and 32-K versions are available now in 20- and 24-pin ceramic or plastic dual in-line packages, respectively.

According to the company, plastic leaded chip carriers for these memories will come out next year. In 100-unit

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Engineers and scientists who join the Center's laboratories at Newport, Rhode Island and New London, Connecticut, are encouraged to take responsibility almost immediately. They design, develop and test prototypes of these systems and work with private industry on production of the final product.

"I got responsibility right away," says Ronald Jackson, an electronic engineer. "As I showed ability, my responsibility grew. Today, I'm a project engineer." Through NUSC's liberal education policy, Ron has earned a master's since he joined Newport and is working toward a Ph.D.

Because the Center helps its scientists become expert in other fields, electronic engineer Donna Doane is concentrating on computer software. "I'm doing things people never have done before," Donna says. "I design the project, and I see it to the end—to the final product." Monica Sachs is learning something new each day. "I'm working on weapons systems engineering, a broad subject that allows you to get into several different kinds of engineering. I use my electronic engineering background to understand the other disciplines." And Peter Santiago applies his computer background to quality assurance. "I look for self-gratification in the job, and I get that at NUSC."

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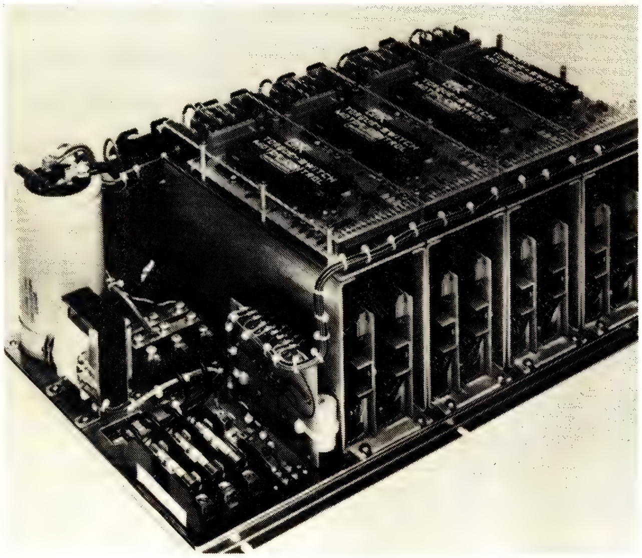
quantities, a 4-K-by-4-bit part is priced starting at $23 and the 4-K-by-8-bit part starts at $75.

Signetics Corp., 811 East Arques Ave., P.O. Box 409, Sunnyvale, Calif. 94086. Phone (408) 739-7700 [Circle 370]

Multi-axis servo amplifiers drive motors up to 5 hp



Directed toward high-reliability robotic, machine-tool, and medical-system applications, the series GA4569 Torque Switch multi-axis servomotor amplifier supplies 60 A at up to 200 V/axis. Models in this pulse-width-modulated series provide two-, four-, six-, and eight-axis capability.

The series is fashioned for integral 5-hp dc motors used with numerically controlled axis or spindle drives that require velocity and/or position control systems. The amplifiers feature high starting torque, virtually no time delays, and an interface to computer-controlled systems. Amplifier operation is monitored internally by light-emitting diodes that indicate low drive power, an inhibited drive, short circuit, and over-current or over-temperature conditions.

The compact size of the series permits the amplifiers to be used where space is limited, such as multiple-axis applications, where several amplifiers are positioned side by side. Features include a ±30-V signal input providing 15,000 A/V gain maximum and a ±90-V tachometer input with 7,000 A/V gain maximum. A four-axis package in a standard configuration sells for $3,075.

Glentek, 208 Standard St., El Segundo, Calif. 90245.
Phone (213) 322-3026 [Circle 383]

Solid-state motor starters eliminate voltage spikes

Previously available for electric motors ranging up through two horsepower, a line of solid-state motor starters now include units for motors from fractional sizes up through 5 hp. The compact, sealed units are especially suited for industries such as chemical manufacturing and food processing because they are impervious to contamination from adverse conditions or cleaning.

Because of the solid-state design, the MacroStart also eliminates the initial line-voltage spikes that occur when contacts close—an important feature in applications such as disk drives, where circuitry is sensitive to noisy line conditions.

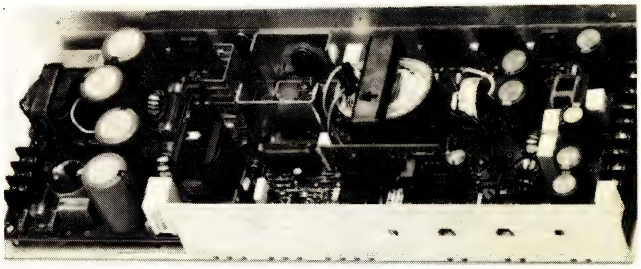
The MacroStart units can be used in place of voltage-sensitive and current-sensitive relays and centrifugal switches. According to the firm, the starters offer longer life, more efficient operation, and improved dependability compared to electromechanical switches.

Macrotronix Inc., 4016 N. Home St., Mishawaka, Ind. 46545. Phone (219) 256-5503 [Circle 384]

Compact switchers suit processor-based products

A 160-to-180-W switching power supply in a 130-W form factor, the model XL160 is the latest member of the company's line intended for microprocessor-based products. Housed in a package measuring 10½ by 5 by 2½ in., the unit includes all features found in the line's other models, including input surge protection, user-selectable 110 or 220 V, and overvoltage (on a +5-V input) and short-circuit protection.

The 160-W unit fills the gap between the company's



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Solid State Devices, Inc., 14830 Valley View Avenue, La Mirada, California 90638, (213) 921-9660

Ready for the next step in power semiconductor technology? Resumes now being considered.

150-W and 200-W supplies. Employing the firm's current-controlled two-stage converter, the model XL160 offers 160 W in still air cooling and 180 W with forced air. The unit complies with various standards, including Underwriters Laboratories 478 and Verband Deutscher Elektrotechniker 0806.

In lots of 1,000, the XL160 sells for $140 each. The XL160 was designed for high-volume manufacturing, which reduces the overall cost of the unit to customers.

Boschert Inc., 384 Santa Trinita Ave., Sunnyvale, Calif. 94086.
Phone (408) 732-2440 [Circle 377]

Uninterruptible power source backs up fully configured PC

The Model 300PC+ power source supplies uninterruptible standby power for a fully-configured IBM Corp. Personal Computer and all the add-on boards a PC can accommodate, as well as a monochrome or color monitor. It also powers computers equipped with hard disks, such as the PC XT, DEC Rainbow Plus, the Apple Lisa with Profile, or a number of other business systems.

When a disturbance in utility power occurs, the 300PC+ provides regulated ac power allowing a typical PC to operate for up to 15 minutes, which is usually sufficient to complete a processing task without losing data. With an exterior design matching various desktop computers, the model 300PC+ powers computer loads with a regulated ouput providing the correct peak ac voltage and the proper root mean square voltage. Its sealed internal battery is maintenance free.

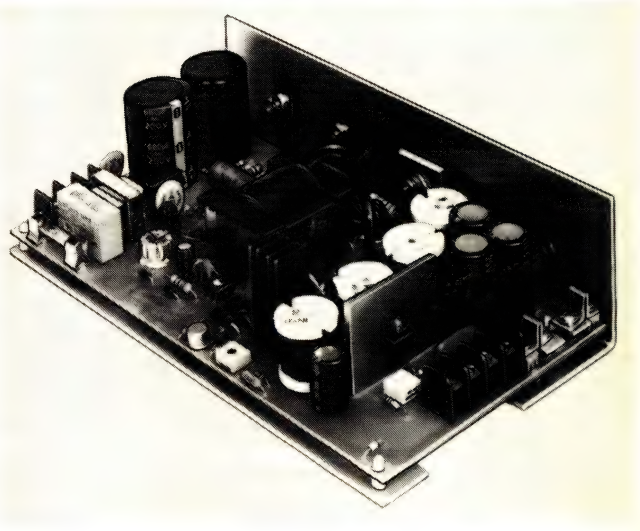
In contrast to other low-cost uninterruptible power systems that either fail to operate properly at light loads or do not regulate the output voltage from the battery and inverter, the 300PC+ operates for any load from zero up to its full 200 W (or 300 VA) rating. Available now for immediate delivery, the model 300PC+ sells for a retail price of $595.

American Power Conversion Corp., 89 Cambridge St., Burlington,
Mass. 01803. Phone (617) 273-1570 [Circle 376]

Surface-mount technology helps shrink 150-W switchers

A line of multioutput, open-frame switching power supplies designated the MCT series uses surface-mounting technology to fit units that supply 150-W into frames measuring 9 by 5 by 2½ in. Features include a switching frequency of 60 Hz to accommodate small magnetic components and a compact proprietary output filter network. Intended for microprocessor-based systems, the line will drive two Winchester disk memories, floppy disks, and a streaming-tape backup.

All four units in the line have identical 5-V, 25-A and 12-V, 5-A outputs. The triple output MCT-309-0512 model also provides a tightly regulated floating 12 V at 2 A, while the third output of the MCT-309-0512S is a semiregulated +12 V at 1.5 A and –12 V at 1 A. The 12-V output meets the ±5% total regulation band recommended by disk-drive manufacturers. The supplies meet various U.S. and international safety standards.



The power supplies, which are available 30 to 90 days after receipt of order, sell for $295 each.

Todd Products Corp., 50 Emjay Blvd., Brentwood, N.Y. 11717.
Phone (516) 231-3366 [Circle 378]

Hard disk records all serially transmitted data

A computer peripheral called the Monitor/One uses a 3½-in. hard disk to record all data transmitted in either or both directions on any serial data line. The data may be played back exactly as transmitted or interpreted to allow nonprinting characters to be viewed.

Data is time-stamped as it is recorded, making it possible to determine exactly when relevant data was transmitted. The device is transportable and can operate unattended at a remote site. An optional tape drive allows the recorded data to be removed and retained for playback or review. Because the device is both hardware and software transparent, it cannot be detected or bypassed unless disconnected.

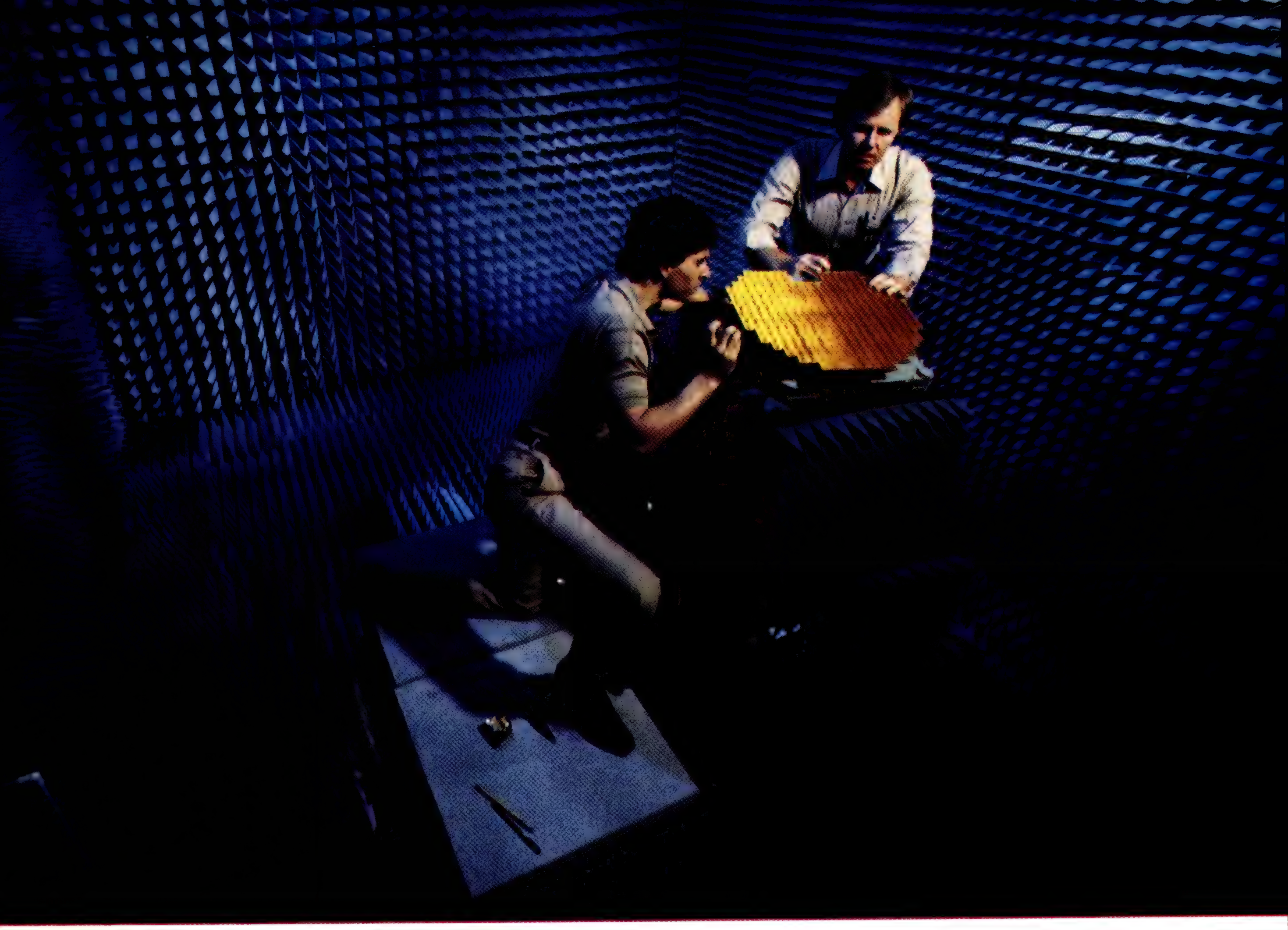
The Monitor/One sells for $3,495 each; initial deliveries are scheduled for the first quarter of 1985.

Passive Technology Corp., 1 Briarwood Lane, Wakefield, Mass.
01880. Phone (617) 246-3902 [Circle 375]

AutoCAD is enhanced by use of direct-input touch device

In Touchpen, a drawing pad, pen, controller board, and display screen that incorporates a micromonofilament-mesh filter are combined to offer the designer a package for computer-aided drafting that permits drawing either on the screen or the pad. (The pad relies on the same mesh technology.) With this package, users can replace the original AutoCAD combination of mouse, digitizer pad or cursor, and keyboard keys.

Screen resolution is 2,000 by 2,000 pixels. The accuracy of the pen is ±0.5 mm, and it covers the mesh at a rate of 22 coordinates/s. To achieve AutoCAD's bidirec-



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tional zoom enlargement, the user touches two points to make a window of the area to be magnified, and continues drawing at the enlarged size.

The controller board occupies one short slot on an IBM Corp. Personal Computer, XT, or AT. The Touchpen is priced at $500. Shipments will start in January 1985.

Sun-Flex Co., 20 Pimentel Ct., Novato, Calif. 94947. Phone (415) 883-1221 [Circle 356]

Chip set simplifies local-network connections

An Ethernet chip set that is compatible with the IEEE 802.3 standard simplifies connections between microcomputers or minicomputers to a local-area network. When combined, the Am7990 LAN controller for Ethernet and the Am7992A serial interface adapter support networking requirements for 10-b/s applications.

The Am7990/7992A chip set features buffer management with descriptor rings, which reduces central processing unit overhead. The chips' 16-bit bus interface is compatible with the iAPX86, 68000, Z8000, and LSI-11 processor lines. Automatic data chaining reduces the memory size requirement, and signal noise filtering minimizes false starts and assures accurate data handling.

The Am7990 also supplies all link-layer functions for Ethernet, but it also provides a flexible interface to the host CPU. A 24-bit-wide linear address provides direct memory address into the entire memory space of all major 16-bit processors. The model Am7990 interfaces with both multiplexed and demultiplexed data bases with a minimum of external logic, and has controls for address/data bus transceivers.

The Am7992A bipolar SIA is a Manchester encoder-decoder that provides the connection between the Am7990 and the Ethernet transceiver cable. Potential false starts are minimized by such features as transient noise suppression and guaranteed signal threshold limits in both data and collision paths.

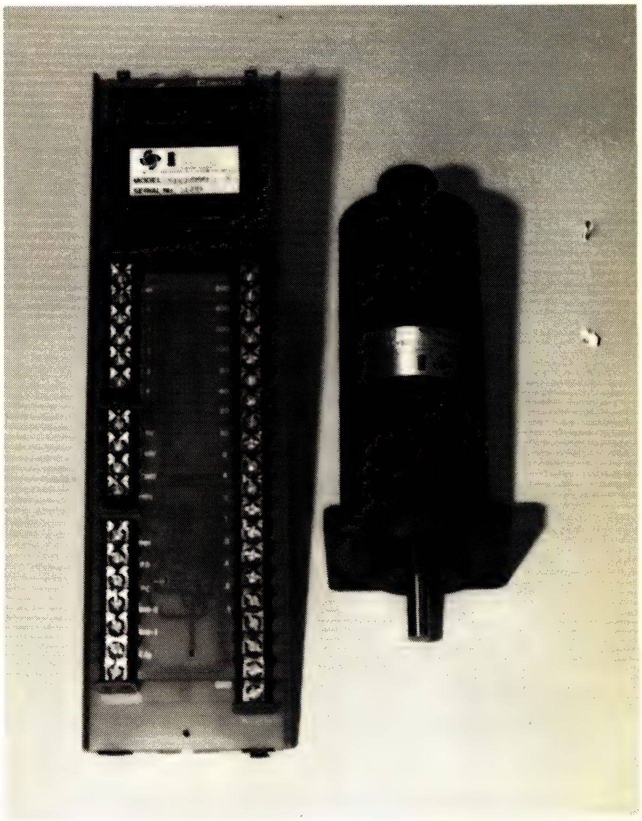
Available now, the Am7990 is housed in a 48-pin, 600-mil ceramic package and sells for $76.50 in 100-piece quantities. The Am7992A, housed in a 24-pin 300-mil ceramic package, sells for $23 each.

Advanced Micro Devices Inc., 901 Thompson Place, P.O. Box 3453, Sunnyvale, Calif. 94088. Phone (408) 732-2400 [Circle 374]

Encoder series is designed for controller compatibility

A series of electromagnetic absolute and incremental encoders is designed for programmable controller compatibility. Systems consist of a National Equipment Manufacturers Association 12 resolver-transducer and remote Snaptrack decoder.

Resolutions of 65,536 parts/turn binary and any prescaled value to 10,000 parts/turn binary-coded decimal are available with a single +12- or +15-V dc supply input. Systems maintain transducer cable runs to 1,000 ft in electrically noisy environments. Since all of Snaptrack's inputs and outputs include industrial-grade terminal blocks, installation can be accomplished quickly with just a screwdriver. Also included are dc velocity, no-motion detector, automatic self-test, and tristate and open-collector output options.



Available now, systems start at $595 each in original-equipment-manufacturer quantities.

Computer Conversions Corp., 6 Dunton Ct., East Northport, N.Y. 11731. Phone (516) 261-3300. [Circle 389]

Shaft-encoding system links directly with a resolver

Capable of emulating absolute or incremental encoder outputs, the SCB-24 series is a complete shaft-encoding system in a plug-in circuit board. Units are designed to interface directly with resolvers, combining an integral 2-VA, 400-to-2,600-Hz oscillator/driver with a 10- to 16-bit resolver-to-digital converter.

Output angular data is available in parallel format via tristate byte-addressable latches or in incremental format (A quad B plus zero marker). Other optional features include a ±10-V dc tachometer output with linearity to ±0.5% and carry/borrow outputs for multiturn applications.

The shaft encoding system's dimensions are 4¼ in. by 6¼ in. The SCB-24 is available now with delivery taking two to six weeks after receipt of order. Prices for the SCB-24 series starts at $440.

Control Sciences Inc., 9509 Vassar Ave., Chatsworth, Calif. 91311. Phone (818) 709-5510 [Circle 390]

SOFTWARE

Management system serves as planner, estimating tool

A project-resource and time-management system is designed for the software manager. It runs on a VAX computer and provides support for multiple users, the facilities to pose "what if" questions, and a capability that allows each project participant to track individual progress.

The system functions as a planner, tracking, and estimating tool. As a planning tool, it allows more accurate forecasting of project completion. As a tracking tool, it shows which projects are ahead of or behind schedule. As an estimating tool, it maintains histories of past projects to allow more accurate forecasts for future projects.

It runs on any VAX model under the VMS operating system, version 3.1 or higher. VAX/Ultrix and PDP-11 versions supporting RSX-11/IAS and Unix are in development for release in 1985. Prices start at $4,000.

Boston Systems Office, 469 Moody St., Waltham, Mass., 02254. Phone (617) 894-7800 [Circle 361]

Package allows MS-DOS software to run under Xenix

The Poppy OS is a software package that allows MS-DOS-based software to run under the Xenix operating system, thereby allowing users to run single-user MS-DOS applications programs in a 12-user multiuser environment.

The package expands the software available for multiuser systems to include MS-DOS-based software such as WordStar, Multi-Plan, and dBase II.

Poppy OS allows the MS-DOS system calls to "speak" to the Xenix interpreter. Hence, the shell enables MS-DOS-based software to function on the Poppy 286/186 Xenix, 80286-based system as if it were operating under MS-DOS. This shell also allows multiple users to run MS-DOS-based software on one Xenix Poppy computer.

Durango Systems Inc., 3003 N. First St., San Jose, Calif., 95134. Phone (408) 946-5000 [Circle 359]

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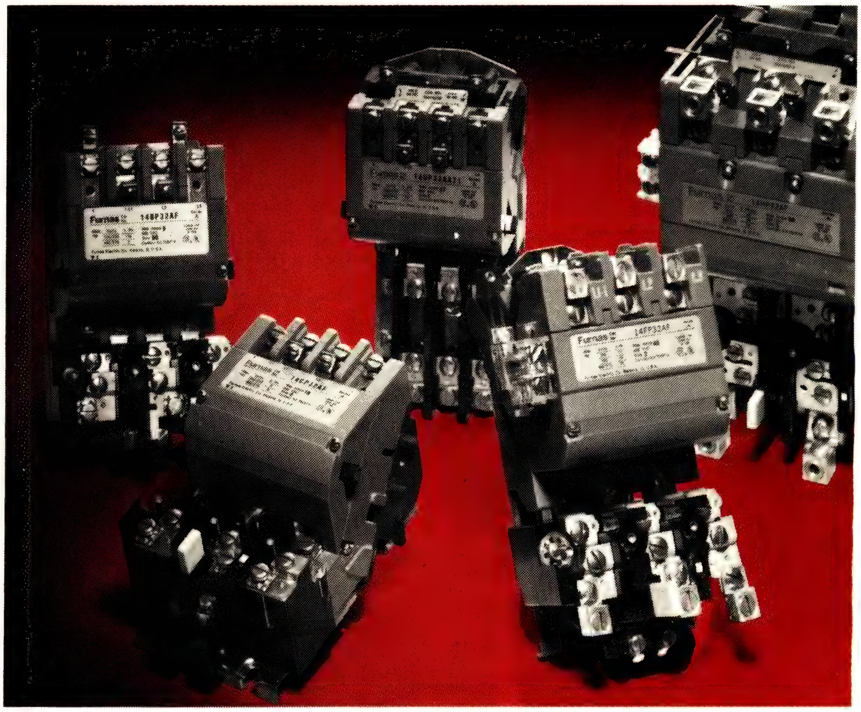

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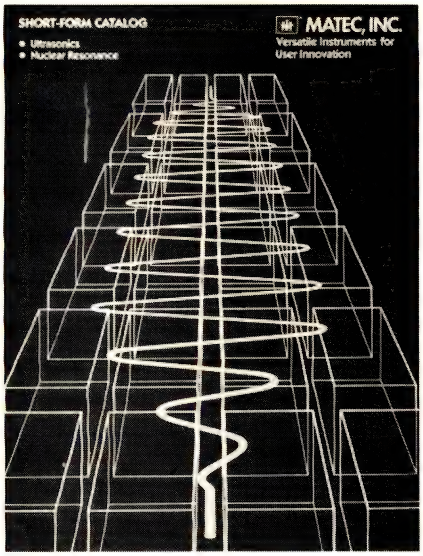
New Literature



Pitch it high. Designed to provide an overview of ultrasonics and magnetic-resonance instruments from Matec Instruments Inc., its six-page short-form catalog includes product photographs, descriptions, and specification tables. Call (401) 739-9030 for a copy, or write the firm at 60 Montebello Rd., Warwick, R.I. 02886. [Circle reader service number 426]

A new year? America's love/hate affair with high technology is revealed in a Louis Harris poll, "Highlights of the Road After 1984." Four hundred leaders in Congress, business, and education, plus 1,256 other citizens, expressed their concerns about privacy, the effect of computers in schools and at work, and other issues. But, surprisingly or not, those who had read George Orwell's novel, *1984*, were twice as likely as those who had not to say we are "not close at all" to a Big Brother-like society. Free copies of the survey are available from Southern New England Telephone, which commissioned it. Call (800) 255-8000, or write to Personnel and Corporate Relations, 227 Church St., 9th floor, New Haven, Conn. 06506. [Circle 421]

PDP-11. The PDP-11 Software Source Book covers applications and systems software for PDP-11 mini- and microcomputers in 33 categories. Prices, vendors' names, and telephone numbers are provided, and compatibility with VAX is noted. The two volumes are free from Digital Equipment Corp., Printing and Circulation Services, 444 Whitney St., Northboro, Mass. 01532 (order number EB-26030-41). [Circle 422]

Stencils. The role of stencil metal masks in solder deposition for surface mounting is covered in a data sheet that is available from Micro-Screen Precision Products, 1108 S. High St., South Bend, Ind. 46618; or phone (800) 348-2993 for a free copy. [Circle 425]

Top of the charts. A chart that shows microwave applications by frequency, covering the major commercial and military applications from 1 to 44 GHz, is free for the asking from Wavetek, P.O. Box 85265, San Diego, Calif. 92138; phone (619) 279-2200, ext. 326. The chart also shows letter designations for both the IEEE-521 radar bands and the military ECM bands. [Circle 423]

Altruism. A national edition of the High Tech Directory of Telecommunications and Computer-Related Associations, priced at $2.50, lists associations that are willing to act as a public resource within their specialties. Order it from Young & Associates Inc., 6187 Executive Blvd., Rockville, Md. 20852. Associations interested in being listed should call (301) 984-8586. [Circle 424]

Saving space. Special prices are offered by Architecture Technology Corp. in a catalog that includes directories, newsletters, the LocalNetter's Design Handbook, and more. Investigate this one by calling (612) 935-2035, or by writing the publisher at P.O. Box 24344, Minneapolis, Minn. 55424. [Circle 427]

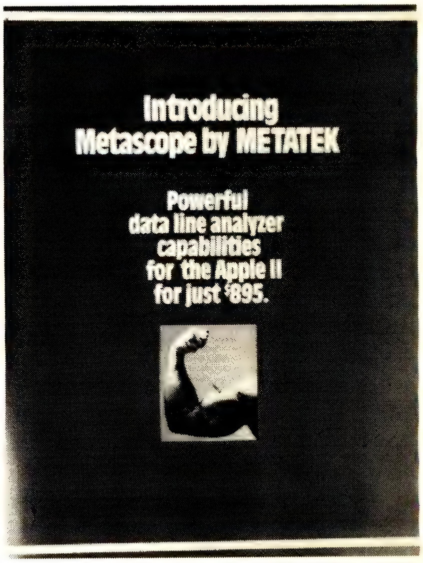
Help is here. Professional books in computer science and research and development are listed in Marcel Dekker Inc.'s free catalog. It's available from the publisher at 270 Madison Ave., New York, N.Y. 10016; phone (212) 696-9000. [Circle 449]

Whatever happened to...? The annual turnover of computer sales personnel is 35%, according to Bob McGrath & Co. Inc., publisher of "Who's Where" and tracker of IBM alumni since 1971. The new edition will list over 4,000 field-management persons from IBM, Wang, and other large vendors, and it is expected to sell for $30. Order it from the publisher at 9451 LBJ Freeway, Suite 220, Dallas, Texas 75243; phone (214) 690-8990. [Circle 429]

Modularity. A360 Vector Bus architecture is highlighted in a six-page brochure that includes four examples of how this modular system can handle different mixed-signal device types. Teradyne Inc.'s Inquiry Systems and Analysis Division gives out copies from 35 Morrissey Blvd., Boston, Mass. 02125. [Circle 428]

Standard bus. The catalog of STD bus products from Computer Dynamics covers board-level products, software, support products, and peripherals—over 130 products. For free copies write to 105 S. Main St., Greer, S.C. 29651; phone (803) 877-7471. [Circle 443]

Watch it. A data-line monitor that runs as a hardware-software extension to the Apple II, II+, and IIe personal computers, the Metascope, is detailed in a four-page brochure from its developer, Metatek Inc., located at 410 93rd Ave. N.W., P.O. Box 33129, Minneapolis, Minn. 55433. For a free copy, call (612) 786-8253. [Circle 430]



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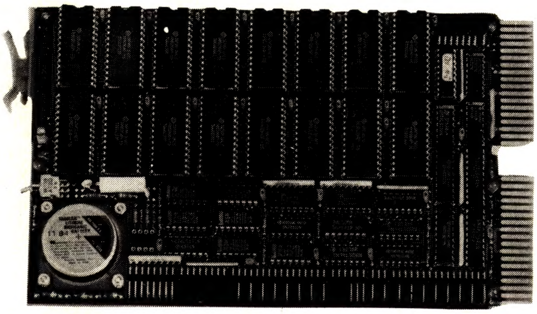

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The holiday season is upon us, and that means that it is the time of the year for *ElectronicsWeek*'s traditional wish list for the upcoming year for the people and companies that make up the industry.

- For the semiconductor industry: A book-to-bill ratio that provides joy despite all the predictions to the contrary.
- For the manufacturers of personal computers: Hardhats to protect them from the aftershock of the coming shakeout.
- For Coleco: Cabbage Patch "parents" eager to buy computers for their Kids.
- For robot makers: Machines that see no evil, hear no evil, and speak no evil.
- For robots: A conference on how to utilize humans on the factory floor.
- For AT&T's computer marketing group: A plan to reach out and touch anyone.
- For government test-specification authors: A list of specifications that actually are worth measuring.
- For computer makers: A superlative beyond "super" to hang on the next stage of large-scale computing.
- For the FCC bureaucrats advocating frequency sharing: A GAO plan for office sharing.
- For Sony: A discovery that the VHS video cassette recorder format is dangerous to your health.
- For Satellite Business Systems: A problem for the solutions it is offering.
- For Jerry Sanders, of Advanced Micro Devices: A starring role in the new Hollywood film, "Hello, Mr. Chips."
- For John Akers of IBM: A sampler, hand-knitted in a hot tub in Santa Clara, Calif., for his office wall, reading, "When in Rolm do as the Rolmans do."
- For all venture capitalists: More entrepreneurs who will assume the Lotus position.
- For the Pentagon's Star Wars program: A new LucasFilms Ltd. production, "Reality Strikes Back."
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- For the United States Air Force: Radiation-hardened coffee for its new $7,500 microwave airborne coffee pots.
- For Exxon: A resurrected and profitable semiconductor subsidiary, perhaps named Exxilog.
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- For research and development engineers: Management that is more concerned about the product line than the bottom line.
- For electronics engineers over 40: Engineering management over 65.
- And for all in the electronics community and their loved ones: A joyful holiday and a peaceful, healthy, and prosperous 1985.

Now you can plan for tomorrow's growth...

but only invest for today's needs.

In the sometimes confusing world that spans from automatic component insertion and parts placement to full factory automation, there are two guidelines worth remembering:

To produce top quality, invest in top quality. Working in conjunction with major electronics manufacturers, Universal has developed a complete family of automatic assembly machines which set new quality standards and deliver increased production. Universal's reputation for producing high-reliability assembly equipment is based upon decades of cooperative effort resulting in the quality and reliability required to meet customer production needs. Not surprisingly, customers repeatedly rely upon Universal to provide the assembly systems required.

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To plan for growth, invest in flexibility. The "building block" concept developed by Universal allows expansion by design rather than guesswork. Only Universal offers a complete family of automatic assembly machines designed to be easily integrated with either a flexible production line or a fully automated factory whenever this is justified by your manufacturing requirements. System-matched hardware and software have been developed to allow step by step expansion that is inexpensive, reliable and uncomplicated. By working with Universal's Sales Engineers, you can develop a system that will meet your company's current needs and "grow" to meet future needs.

Universal's Sales Engineers and Factory Automation Specialists will welcome an opportunity to analyze your current and projected needs and show you how your company can benefit from the increased production and improved product reliability that only Universal's electronic assembly systems can provide. Contact your Universal sales office or send for more information.

Universal®

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BRAND-X *or* POWER-ONE FLEX?

"An Unfair Comparison"

You Shouldn't Compare Apples and Oranges

We apologize for our unfair comparison. But when it comes to POWER-ONE's new FLEX-Series D.C. power supplies, there really isn't anything comparable on the market.

Based on 11 pre-designed case sizes, with power ratings from 10 to 400 watts, the FLEX-Series dramatically simplifies the development of custom power supplies. You can specify the exact output ratings and options you want... *at a fraction of the cost and time of a full custom design!*

Built to Your Exact Requirements

With the FLEX-Series you pay only for the features you specify. And using our "Total Package" concept there's no additional assembly labor, no extra parts to buy. As for options, you name it. Virtually any output voltage and current combination is available. There's connectors, fans, covers, front panel assemblies; there's power fail monitoring, high surge current capabilities and much, much more.

Safety Approved Worldwide

The FLEX-Series is certified to the world's toughest safety agency requirements. Which means you can take delivery of an internationally approved power supply, built to *your exact specifications*, in the *shortest leadtime* in the industry!

Call for a Quotation

Whatever your quantity needs — large or small — the FLEX-Series will save you time and money. Plus, it's POWER-ONE proven. So call today for a FLEX-Series quotation. Or get the full FLEX-Series story in our new 1985 Catalog. You'll agree that all other custom power supplies are nothing more than BRAND-X when compared to the flexible FLEX-Series.

"Innovators in Power Supply Technology"

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D.C. POWER SUPPLIES

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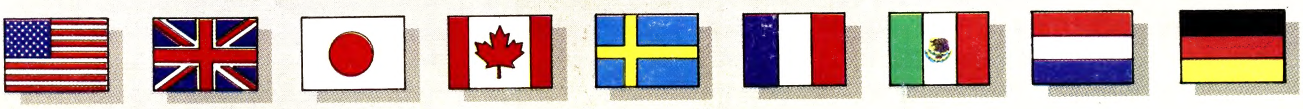

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